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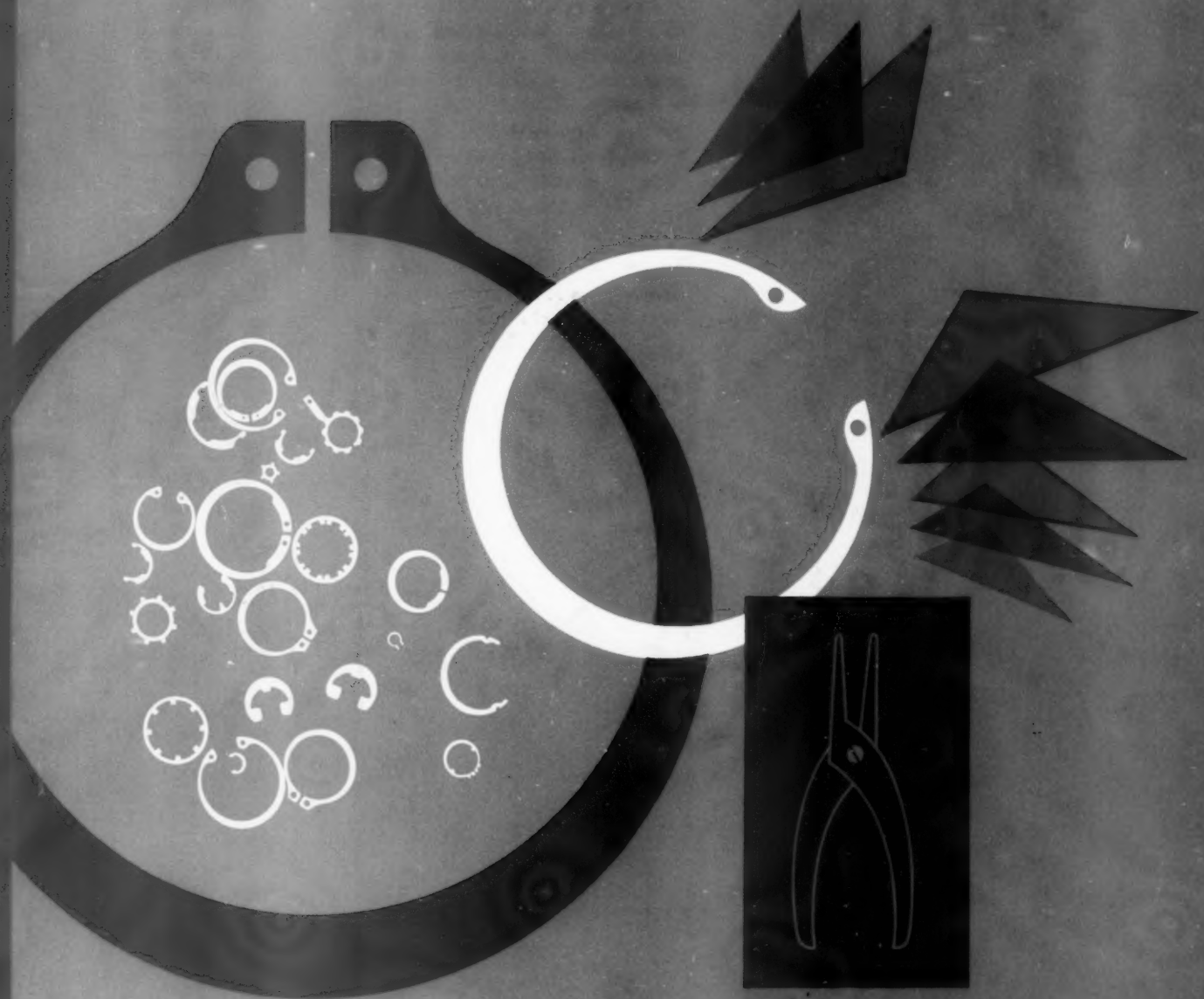

MAY · 1959

In this issue:

Design and Application of Retaining Rings

Tightening Threaded Fasteners—Part I

Progressive Line Changes Boost Welding Efficiency

Project...program...production

This man is solving a fastener problem

the Pheoll *way!*

More than a fastener's function is under consideration when a Pheoll product engineer bends over his drawing board. Kept in mind, also, are the specific capacities of the particular Pheoll production equipment upon which it will be formed. For it is only through this attention to factors involved in *both* areas—design *and* production—that the men of Pheoll's "specials" team are so often able to come up with the *right* answer, at the *right price!* Why not try *your* problem on us? Simply outline the details to your Pheoll field representative. He's as close as your phone.

THE MAN IN THE PHOTOGRAPH, incidentally, *is* a member of Pheoll's design group . . . *Chief Product Engineer* Edward Tauscher, 10 years the head of design operations . . . *at Pheoll!*

Pheoll Manufacturing Company
Industrial Fastener Division
5700 WEST ROOSEVELT ROAD
CHICAGO 50, ILLINOIS

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assembly & fastener ENGINEERING

May, 1959 Volume 1, Number 8

FEATURES

The Recession: Lessons to Learn 7

Dr. Arthur Burns discusses how the past recession differed from previous ones, and what it has taught us to look for in the future

Tightening Threaded Fasteners—Part I 24

This first of two articles on "power tools for tightening fasteners" discusses shear and tension, types of fasteners, and considerations for torque.

Design and Application of Retaining Rings 30

What types are available? What type do you use for which purpose? How are they effectively used and assembled?

Computer Assembly Techniques 37

The complexities involved in the assembly of a highly-precision electronic product such as the Autonetics office-type computer are described in detail.

Line Changes Boost Welding Efficiency 42

Radical changes in Temco's welding department helped overcome a problem of 10 percent rejects in final assembly of gas heaters.

1959 Design Engineering Show 46

A press-time review of some of the products to be exhibited in Philadelphia, May 25-28.

DEPARTMENTS

2 Letters to the Editor
5 The Editor's View
8 Business Notes
11 Industry at Work
15 Assembly & Fastening Ideas
19 Reports from the Field
49 What's New in Equipment
55 What's New in Fasteners
61 Useful Literature
65 Industry Makes News
71 Product Index
74 One Last Word

• One of the newer types of fasteners is the retaining ring which is finding many uses since its introduction in this country in 1942. For a report on design and application, turn to page 30.

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BEFORE...
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AFTER...
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save dollars

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In the actual case shown, savings were pyramided through reduced inventory, handling, purchasing and production time; while one part was eliminated entirely.

To make this basic information available, Buffalo Bolt Company has drawn on over 100 years of experience to put together a digest of these principles.

You'll find them in our new booklet, "How to specify fasteners . . . and save". Filled with drawings and charts, it makes a handy guide in designing or buying any headed parts. If you can use a copy, write to North Tonawanda or ask a Field Representative.

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Letters to the Editor

What Is Proper Torque?

In your February issue, you published an article entitled, "What Is Proper Torque?". If there are any reprints available of this outstanding article, I would appreciate a copy.

H. B. Wylie
Development Engineer
General Electric Company
Holyoke, Massachusetts

Adhesive Bonding

In your March issue there was an item on page 61 concerning an adhesive made by Eastman. Please advise the full name of this company and its address.

Congratulations to you on this new and needed trade paper.

W. N. DeTurk
Senior Designer
Teleflex, Incorporated
No. Wales, Pennsylvania

Engineering Enrollment

The editorial in April spells out in clear words why many young men do not wish to enter the engineering profession. May we have about ten copies?

E. W. Schoen
Chief Metallurgist
Huck Manufacturing Co.
Detroit, Michigan

Who If Not You?

Please send me a copy of your editorial comment, "Who, If Not You? When, If Not Now?", which was noted in your January issue.

Victor F. Pastushin
President & Gen. Mgr.
Pastushin Aviation Corp.
Los Angeles, California

I appreciated your editorial in January. The sign you mentioned impressed me as one of the best thought-provoking presentations I have ever read. I would be grateful if you sent me one.

Ralph W. Jones
Remington Rand Univac
Div., Sperry Rand Corp.
St. Paul, Minnesota

Thanks for sending the "Who If Not You?" card. Response to your offer has been so gratifyingly big that we want to add our request for another 35 cards to pass out to our various supervisors.

J. Weber
Plant Manager
Fruehauf Trailer Co.
Avon Lake, Ohio

Design Analysis On Fasteners and Small Parts

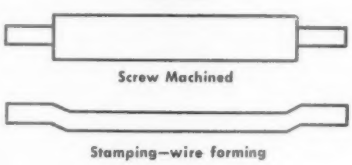
Hassall Re-Design Often Means Big Savings on Parts

The most important consideration we can point out to the designer or purchaser of fasteners and small parts is that any part which can be machined from rod stock is also potentially available from the cold heading manufacturer. This technique offers speed of production, without scrap loss, plus superior strength and appearance for low cost and high design efficiency.

Perhaps our greatest contribution to your operation is our re-design service. An expert cold heading designer can very often study your drawings and come up with a modified part which will be lower in cost, stronger structurally, and easier for you to assemble.

This spacer is typical of such a Hassall re-design. Note the customer's drawing . . . this is a stamping, not too accurate, with poor bearing surfaces and not too easy to handle in assembly.

BEFORE



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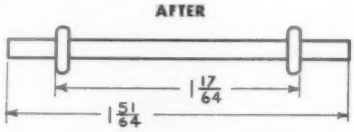

Cold Headed

Now, look at this spacer as redesigned for cold heading. Now, a double collar spacer which is very accurate, structurally much stronger, and with much better bearing surfaces. And lower in cost!

Given complete specifications, including a drawing and an idea of the application, we can quickly tell you whether or not it will be advantageous to have your part or fastener JOB-DESIGNED by HASSALL.

Write today for your copy of our new Catalog No. 106.

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Got a problem that calls for thread-cutting screws?

PARKER-KALON offers three new, improved thread-cutting screws for every application in every material

1 New, Improved P-K Type F*

. . . hardened thread-cutting screws developed for use in friable, granular or brittle material. The pilot, with its five tapping flutes, cuts a machine screw thread as the screw is turned in. The Type F is ideal for making fastenings to ferrous and non-ferrous castings, bronze or brass forgings, heavy gage sheet metals, structural steels, plastics and resin-impregnated plywood.

2 "Pentap"... the new, Improved P-K Type B-F*

(formerly F-Z) combining the five thread-cutting flutes of the Type F screw with the coarse-pitch, widely-spaced threads of the P-K Type B. The thread-cutting "Pentap" Type B-F distributes cutting pressure evenly, lets chips drop to the bottom of the hole, and prevents cracking of material. It is designed for making fastenings to comparatively thin sections and bosses in friable and brittle plastics.

3 P-K® Type L†

. . . is a completely new and improved thread-cutting screw developed by Parker-Kalon especially for use in Nylon. The Type L functions as a combination thread-cutting and thread-forming screw in that it cuts a small amount of the Nylon to allow the full diameter threads to form. Type L offers a particular advantage in Nylon assemblies which must be disassembled for service, because *the P-K Type L can be removed and replaced without stripping or galling.*

The five cutting flutes on the new, improved P-K Type "F" and "BF" reduce pressure development by 80 percent! The completely formed threads on these screws have sharper cutting edges, and 5 deep flutes that are of continuous depth. These features make for better clearance of the accumulated material and assure minimum stresses in driving, and avoid the possibility of stripping or galling.

FOR SEMS . . . and Neoprene or Nylon washer **STAPS®** in thread-cutting and thread-forming tapping screws, or machine screws in any kind of pre-assembled fastener-washer combination, P-K can supply them, too!

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*Patent Pending †U. S. Patent 2,350,346

FOR SAMPLES OF P-K THREAD-CUTTING SCREWS AND SEMS, CALL YOUR LOCAL P-K "BULK-STOCKING" DISTRIBUTOR

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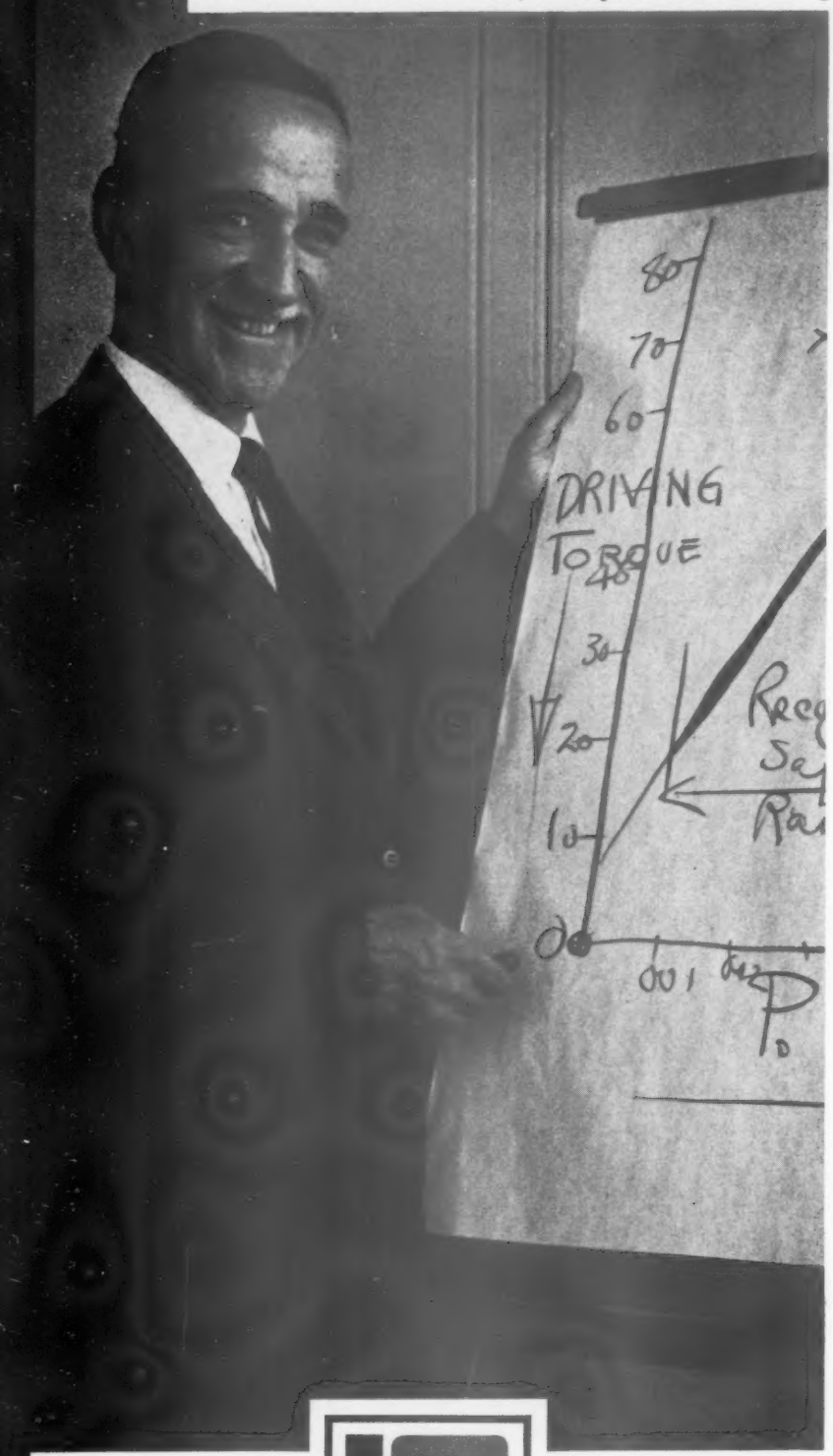
PARKER-KALON DIVISION, General American Transportation Corporation, Clifton, New Jersey • Offices and Warehouses in Chicago and Los Angeles

WILLIAM G. WALTERMIRE, *Chief Products Engineer, Lamson & Sessions, says...*



Your interest... and ours... is "assembled product cost"

Many fastener users think only in terms of unit price. Actually, labor costs of assembly are usually 3 to 4 times the price of the fastener itself.

Your job, and ours, is to find practical ways to cut your "cost of assembled product". To do this, we frequently hold meetings with purchasing personnel, design engineers, standards engineers, and quality control people at our customers' plants.

By means of charts and slides, we show how to simplify types and sizes of fasteners used, which reduces purchasing and inventory costs. We guide them in selection of thread classes to meet different material, tapping and assembly problems. We often suggest ways to improve strength and cut costs—by substituting a smaller high carbon fastener for a larger size, low carbon type. Or we may suggest redesign of a bolted assembly to use standard instead of special fasteners.

Take advantage of this no-charge L & S service. Call or write us for an analysis of *your* fastener problems.

L & S Fastener Engineering helps you "tighten up" on...

- PURCHASING COSTS
- INSPECTION AND HANDLING COSTS
- ASSEMBLY COSTS

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MAY, 1959 VOL. 1, NO. 8

AUTOMOTIVE PROGRESS IS WONDERFUL, BUT....

With the coming of spring many a motorist has uttered a sigh of relief. He has said goodby to probably the roughest winter he has ever encountered. But the nagging question lingers on in his mind whether the automotive industry has progressed to the point where its products are designed to provide a winter subsidy for those engaged in service work.

On one bitterly cold morning my neighbor complained, "These new cars are for those birds living in Florida." He had just ground down his battery trying to get his previous pride and joy started, so I offered my help. We had often exchanged neighborly pushes with great success in past winters. But it seems that his car just can't be started this way. So he had to wait out the appearance of a very busy service man with his tow truck and booster battery.

Let's review this wonderful progress from the motorist's standpoint on a sub-zero morning.

Way back in the old days of the bruised knuckles, he cranked the engine to start his car. Then came the revolutionary starter which took the drudgery out of starting the car. But just in case the battery failed, he could still use the crank.

Then the crank became passé. But fortunately, if the car wouldn't start right off in cold weather, it could be placed in gear and backed out to the street with the aid of the starter. All that was needed then was usually a neighborly push.

Next came the automatic transmission which made driving even more of a pleasure, especially for novices. However, the car could no longer be moved with the starter, but if you could get it out to the street, you could still get a friendly push.

And now some of the '59 models can't be started by pushing. Even if pushed in neutral gear, the transmission may be damaged. "This is progress?" asks the disgruntled motorist, as he views with alarm the service call which has become a necessity instead of an occasional luxury.

Automotive designers insist that their cars are stylized and engineered to suit the tastes and desires of prospective owners. These facts are determined by answers given to questions asked in so-called depth surveys.

Perhaps these surveys get off their planned constructive plane because of the way the questions are asked.

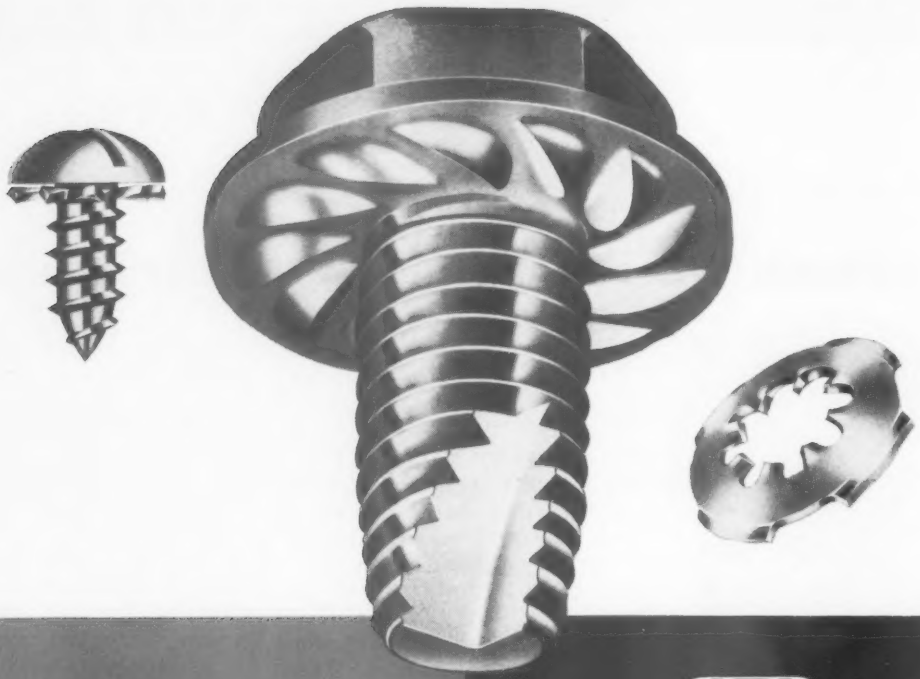
Ask the average motorist on a bright sunny day if he wants his next car to have an automatic transmission, and he's likely to give out with a brash one-word answer, "Certainly!"

But he may hedge and say, "Well, maybe," if the question is realistically phrased: "Do you want an automatic transmission in your next car—even though you are aware that if it won't start on sub-zero days that a service call is absolutely necessary?"

It's time for automotive researchers to be more realistic in their surveys of the needs of the American motorist. Perhaps there's more in the big influx of foreign cars than just initial cost and mileage economy.

Matt E. Hensley

Managing Editor



HOW TO SELECT
COST-SAVING

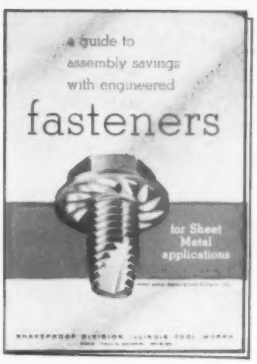
fasteners for sheet metal

A TYPICAL EXAMPLE:
How to Avoid Stripping–

When high stripping torques are required, a Shakeproof NIBSCREW* should be used. "Nibs" under the head take up excessive driver torques and eliminate loose screws, re-work and repair.

You can realize important savings on your assembly line by specifying fasteners that eliminate operations, speed up production and assure highest quality. Engineered Fasteners by Shakeproof now overcome stripping, provide sealing, assure maximum locking and solve countless production problems encountered in mass assembly of products using sheet metal.

SEND FOR NEW SHAKEPROOF BULLETIN NO. 100!
Illustrates twelve typical examples of cost saving fasteners for sheet metal applications. Describes important "check points" for fastener selection. Offers testing samples. Write for your copy today!



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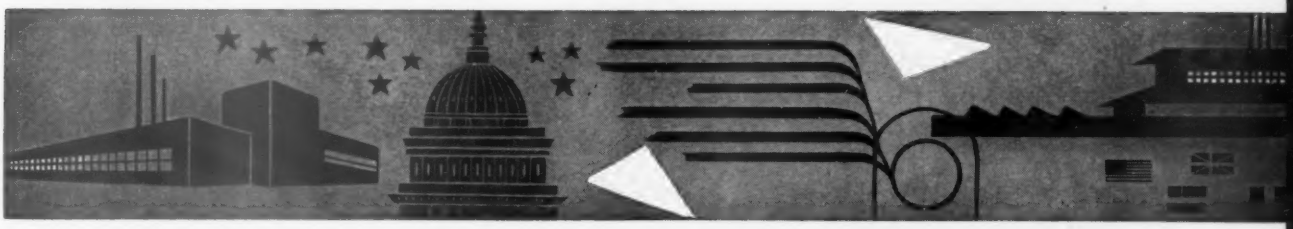
The State of Business



THE RECESSION: LESSONS TO LEARN

The recession had many features of the typical business slump of history: decline of investments, falling production as sales diminished, mounting unemployment, shrinking profits, business failures.

Factory outputs declined 13%; mines, 17%; construction, 6%; railroad traffic, 20%. Over-all physical output diminished about 6%, corporate profits fell more than 30% and unemployment reached the highest post-war level.

It is the divergences from the classical model, however, that have most to teach us as we look to the future.

Brevity was one feature of the recession. Although production decline was sharp, the recession was one of the very shortest downswings in business cycle history. The decline began in August 1957, reached a trough last April, with activity rising since.

Another striking feature is the new evidence that a slump in production under modern conditions need not involve a slump in personal incomes or in consumption. Though during 1957-58 aggregate personal income did not rise, as during the 1953-54 recession, the decline was extremely small (1%).

DR. ARTHUR F. BURNS

Pres., National Bureau of Economic Research

With a 30-line biography in "Who's Who," professor, author, consultant Burns is one of the world's foremost economists and past chairman of the President's Council of Economic Advisors, 1953-56.

This loosening of the ties between production and the flow of personal incomes resulted from the more or less automatic workings of certain of our institutions, not from deliberate anti-recession policies of the government. Corporations generally maintained dividends at an unchanged rate, as is their custom in the early months of an economic setback. The Treasury absorbed a considerable part of the decline since the revenues yielded by income taxes automatically drop as incomes and profits fall.

The virtual stabilization of personal incomes helped powerfully to maintain consumer spending during the recession—people remained generally optimistic.

The scale and character of Federal intervention is a third feature deserving notice. Credit conditions were eased through successive decreases of reserve requirements and of the discount rate. Special measures were adopted to liberalize housing credit. The processing of tax refunds and of loan applications was speeded up. Some tax adjustments were made to aid the railroads and small businessmen.

The main emphasis of Federal policy, however, was put on raising expenditures and when they were finally added up over a series of months the total was much larger than had been planned or advocated by the fiscal authorities of our government.

Behavior of wages and prices is a fourth feature of the recession. Here is new evidence that, with brief pauses, the trend of the price level is still upward. The main reasons for this are familiar: trade union power, coupled with the increasing tendency for business to compete on the basis of the type of product, its quality, and the services accompanying its sale, rather than on the basis of price.

Looking now to the lessons which can be learned, one important lesson is that the so-called automatic stabilizers have worked well again. In view of this accumulating experience, it would be practical to strengthen them. The most useful step that we can take now is to liberalize our unemployment insurance system.

That monetary and credit policies can be more effective during a recession than is commonly supposed is a second lesson. The increase of some $10 billion in commercial bank investments, which the easing of credit made possible between September 1957 and last May was, I think, a significant factor in speeding recovery.

continued

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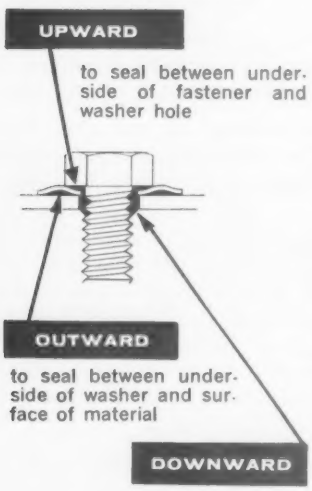
UPWARD
to seal between under-side of fastener and washer hole
OUTWARD
to seal between under-side of washer and sur-face of material
DOWNWARD
to seal between clearance hole and fastener threads

BARTITE sealant material is an integral part of the metal washer, a single unit, ready for quick assembly and positive sealing action.

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*Patents Pending U.S.A. and Foreign.

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State of Business, continued

That government spending lags far behind decisions to spend is another fact to remember, involving public works, construction, defense, education, foreign aid and health research.

For better or for worse, policies that are undertaken to check recession have consequences which spill over into later periods.

Gravest lesson is simply that we now have less reason than before to expect that any substantial part of the advance of the price level which normally occurs during business expansions will be erased during business recessions.

The way to start towards an anti-inflation policy, in my judgment, is to first amend the Employment Act so that reasonable stability of the consumer price level will be explicitly included among the high objectives of the government to promote.

Next, we need to review the patchwork of special legislation that has evolved through the years in the form of price supports, import duties, import quotas, wage regulations, stock-piles and subsidies—all of which tend to raise prices.

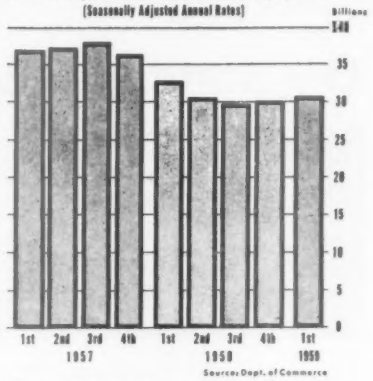
Better defenses against monopoly powers, whether in business or in labor relations, need to be devised. We need to establish productivity councils to spot industrial wastes and promote improvements in efficiency.

A review of tax laws, with a view to carrying out reforms that may spur productivity, is needed. We need to keep a firmer rein on public expenditures in times of advancing prosperity and develop better budgetary controls.

Ways of enhancing the effectiveness of monetary policy in our new economic, financial and political environment are needed. We need to improve the consistency and co-ordination of economic policy-making with the government so that balanced judgment may be brought to bear on both the long-range problem of inflation and any immediate problem of recession or substantial unemployment. ●

Business Expenditures for Plant and Equipment

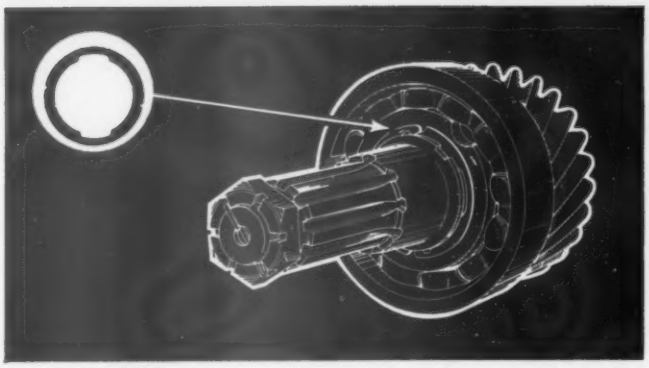
(Seasonally Adjusted Annual Rates)



After declining over 20 per cent, plant and equipment outlays have leveled out.

Industry Briefs

Keen auto sales competition sees Ford leading Chevy by some 50,000 units in early April. Any GM victory could be tasteless, however, since money-making Ford is in its third year on the same frame, Chevy retooled . . . Pittsburgh Plate is silent, but Chrysler's decision to produce 50% of its own glass hurts plenty and proves that strikes (142 days) sometimes do backfire . . . IBM's proposed 3 for 2 stock split will still leave shares at a lofty $358 . . . Defense Department wants to sell its $60 billion surplus equipment costing $100 million annually to store and handle. When Congress okays, items will bring in about $10 billion . . . The FTC is fighting House Commerce Committee Chairman Harris' (D, Ark) bill to set up a national fair-trade system . . . Foreign steel importers are capitalizing on unsatiated, strike-fear-inflated demand with prices just below U. S. levels. Management will contend that wages should be kept constant to compete with this overseas competition, while labor says that 3% of the market is 'peanuts' . . . Ike's economic advisors look for a summer 1959 boom with unemployment dropping below three million . . . Republic Steel's C.M. White looks for a 60-ton industry output for the first half of '59 compared to 38 tons for the same period last year, with year's total production (110-tons) the same with or without a summer walkout. ●



Heavy duty transmission design simplified. On this dual axle drive for trucks, a Truarc Series 5107 ring locks bearing on drive shaft. Interlocking ring design won't dislodge under heavy torque . . . is also recommended for high rpm. applications.

Designing with radially assembled Waldes Truarc retaining rings

solve varied product design problems—save machining, materials, parts and labor

Radially assembled retaining rings, which snap onto a shaft at right angles to its axis, greatly extend the range of products on which retaining rings may be used to simplify design and save parts or labor costs.

For example, rings for radial assembly can be used in applications where it is impossible to install a ring axially over the end of a shaft. Certain types are designed to accommodate shafts of relatively wide tolerances. Others described below may be used to provide a sizeable shoulder on a shaft.

The four applications shown here provide an indication of the wide range of products using radially assembled rings. The rings themselves are basic Truarc types each having specific design features. The high shoulder of one provides a large bearing surface on small diameter shafts; the low shoulder of another is ideal where clearance is limited. A third has an interlocking design which prevents it from being dislodged under torque or high rpm. A fourth can be used against rotating parts at the same time it provides spring tension.

These are but four of Truarc's fifty functionally different types of retaining rings with up to 97 sizes within a single type, six metal specifications and thirteen different finishes. Special hand, magazine, and semi-automatic applicators as well as grooving tools are also available to speed production. The entire line, together with over 70 typical applications, is described and illustrated in the new catalog RR10-58—yours for the asking. And call on us for design assistance on your specific project . . . a Waldes Truarc engineer will be glad to help. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

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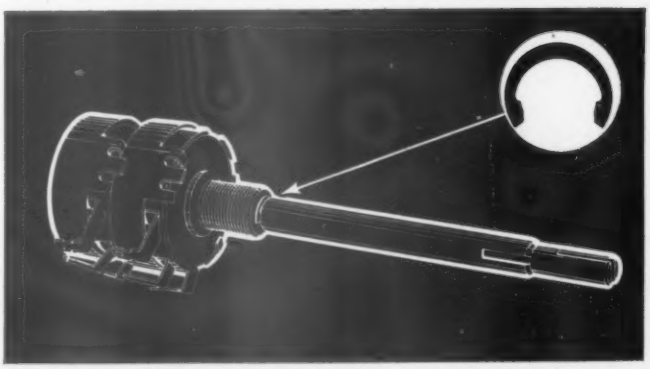
Rings replace machined shoulders, collars, set screws. That's what original design of this pneumatic temperature transmitter called for. Series 5139 Prong-Lock® ring with bowed design compensates for accumulated tolerances in parts, provides sufficient friction to prevent rotation under vibration. At the same time two Waldes E-rings position and lock adjustment screw to face plate.

Reinforced aluminum ring gives design advantages on louver windows. Waldes Truarc Series 5144 reinforced rings of aluminum secure hinge pins, eliminate costly riveting in linkage of louver type window. Ring design provides large bearing shoulder. Reinforced construction has 5 times the gripping strength of standard E-ring construction, allows use of non-corrosive aluminum.



Ring acts as locking shoulder. Holding the threaded ferrule on this potentiometer shaft is a Truarc Series 5103 Crescent® ring. Crescent ring design with low shoulder provides ample clearance for assembly of panel locknut. It is less costly than a machined shoulder, more effective, quicker to install, easier to remove than the C washer previously used.

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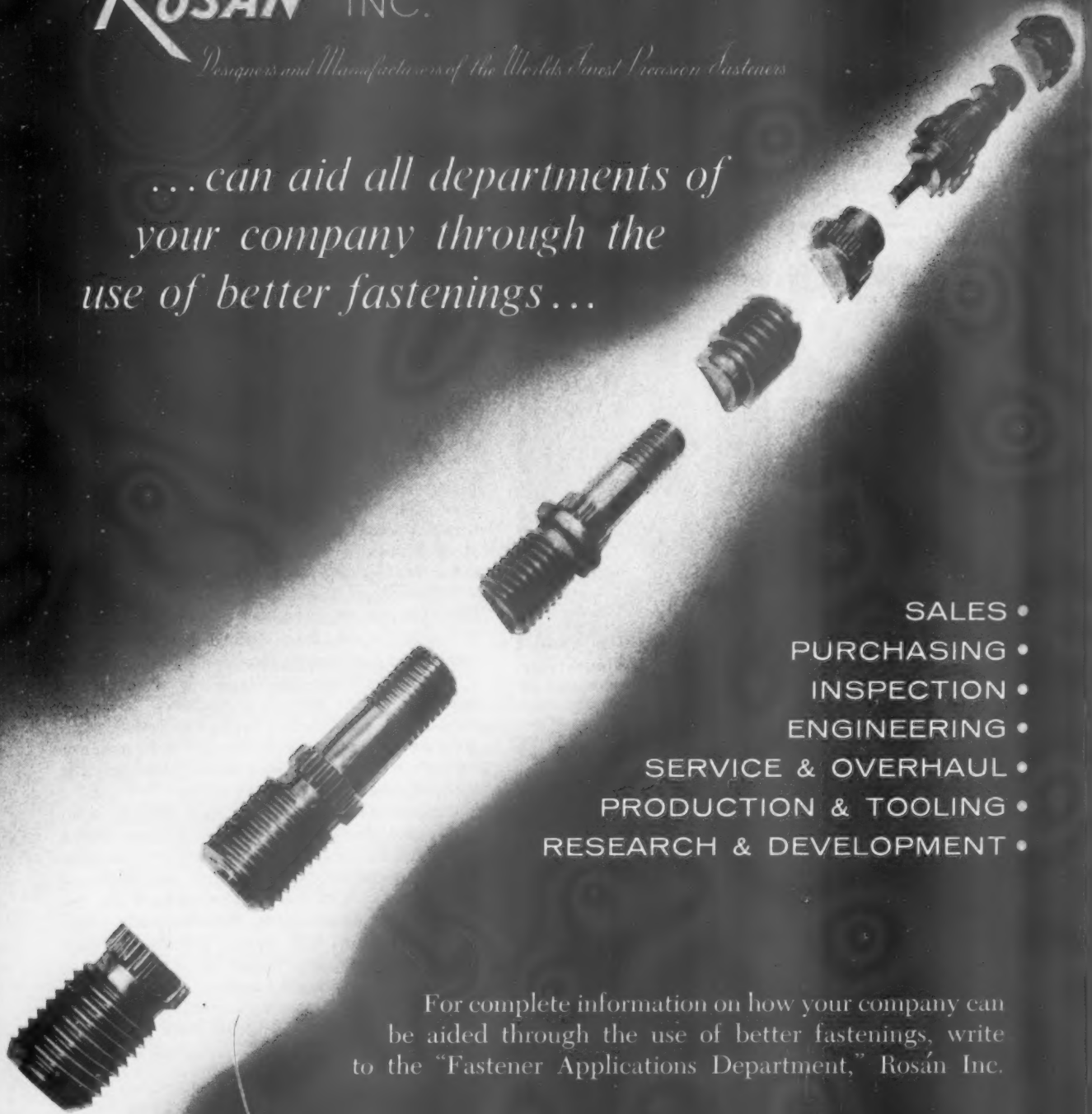

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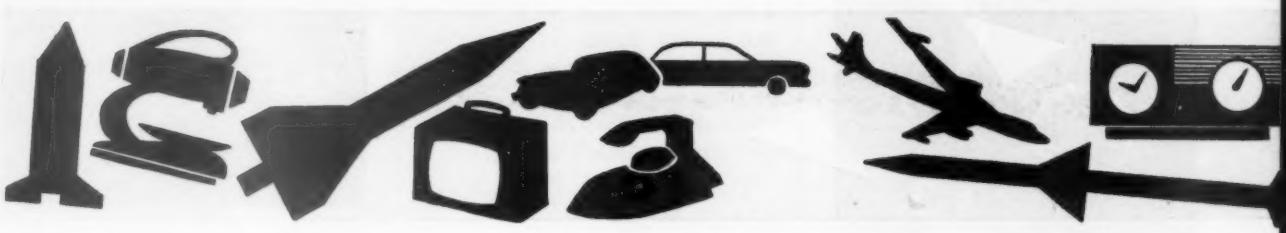

FABRICATOR LICKS TOUGH FORMING, ASSEMBLY JOB ON THE '59 CHEVY

A 150-ton press makes a 5" irregular form, the first of 18 steps needed to fabricate this one critical part of the 1959 Chevrolet.

Final test given brace assemblies employs 15 gages to check the alignment of 19 holes in the part.

Chevrolet's much-talked-about 1959 changes go much deeper than exterior styling. The new car year has brought new designs to many of the steel parts which the car owner is unlikely to see very often, if ever.

One such part is the strong steel assembly which braces the steering column, fastens the instrument panel to the dashboard and supports the brake pedal.

For Falls Stamping and Welding Company, Cuyahoga Falls, Ohio, modifications in the brace assembly make 1959 a repeat of 1958—when production of this part ranked as one of the toughest jobs in the shop.

The principal modification specified for the part is its greater depth. The assembly is deeper in section for 1959 because the clutch pedal return spring has to be rotated up more in assembly. While this applies only to units with the three-speed transmission, Chevrolet determined that it would be more economical to deepen the section of the cowl-to-dash brace rather than weld on a separate bracket to which the spring could be hooked. Increasing the depth of section increases the section modulus and therefore its strength.

Said Andy Kariotis, of Falls Stamping: "With a deeper form, we've got everything riding on the uniformity of gage in the hot rolled sheet steel we use for the assembly."

Of the 18 operations set up in manufacturing the part, the first two forming operations are the most critical. In the first, a 150-ton Niagara press makes an irregular and deep form, ranging from 2.86" at one end of the piece to 5" at the other. In the next operation, a 125-ton Niagara forms the ears and flanges of the assembly.

"Our reject rate," says Kariotis, "is lower than we had any right to expect, considering the deep form and the fact that in forming the ears they are bent to a 90° angle and simultaneously twisted." He attributes the low reject rate and the company's steady production of 35,000 brace assemblies monthly to the formability characteristics of Jones & Laughlin hot rolled sheet steel used for the part.

continued

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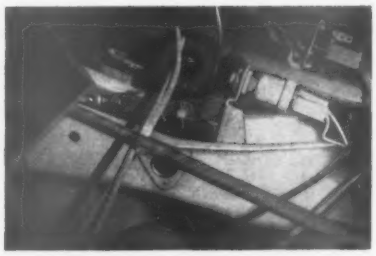
Kariotis added: "The key to the whole operation as far as we're concerned is that the hot rolled consistently meets tolerances within the 13-gage range. We can stand some range, but any great variation would throw off the dies or flare out the steel and destroy alignment of the 19 holes specified for the piece."

The importance of correct hole dimensions and alignment is evident in the tooling set-up for the assembly. Three of the operations are concerned merely with reaming the punched holes.



The brace assembly in position beneath the '59 Chevy dashboard. The many interconnected parts require precise alignment of 19 holes specified for the piece.

REYNOLDS DESIGNS SUBMARINE FOR DEEP-SEA EXPLORATION

An aluminum submarine which will plumb ocean depths three miles below the surface and realize the dreams of oceanographers for deep-sea exploration is being designed by Reynolds Metals Company, announced J. Louis Reynolds, executive vice president.

The Aluminaut will be about 48′ long, with a 30′ cylindrical pressure hull of 6″ aluminum plate. Its 7′ inside diameter will accommodate a pilot and two scientific observers, together with more than 3400 pounds of scientific instruments.

In addition to a stern propeller the vessel also has a vertical propeller which will permit hovering and staying in place for special observations. The vertical propeller also will help to control rate of descent and ascent.

The main propulsion motor and control system power units will be mounted within a completely independent stern capsule, filled with oil for pressure equalization.

The feasibility studies under Adm. D. H. Day, USN Ret., indicate that the Aluminaut would be capable of exploring at 15,000 feet depth for 36 hours, with another 36 hours emergency allowance.

The Aluminaut will be bolted together and the seams will be caulked and bonded with a special adhesive that is now used in bonding the aluminum skins of some jet airplanes.

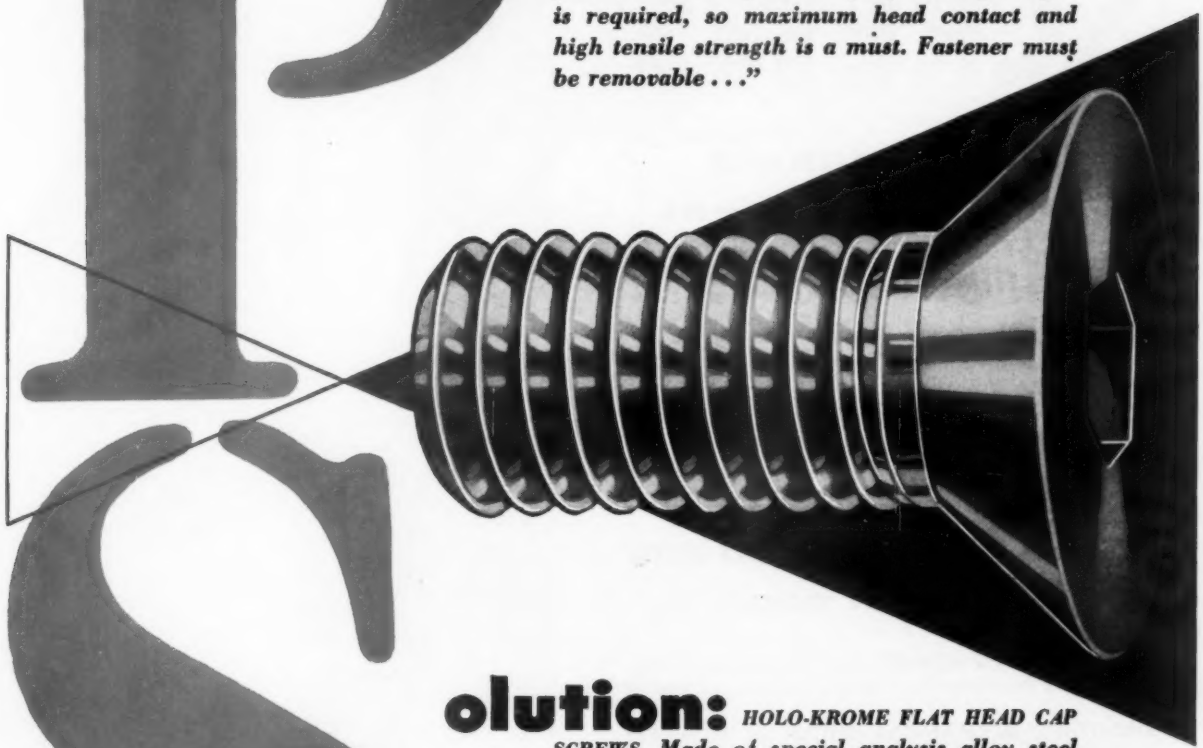
The feasibility studies included pressure testing of several aluminum alloys of varying thicknesses. The 6-inch plate finally selected will solve the primary problem confronting submarine designers —that of providing sufficient strength to withstand the pressure of extreme depth, without the need of a material so heavy as to defeat its buoyancy, Reynolds said.

NEW STRUCTURE CONTROLS PLANT ENVIRONMENT

A unique new type of structure for use where rigidly controlled environment is necessary for testing, assembly, repair or packaging has been developed by Moore & Hanks Co., El Monte, Calif.

"Packaged environment" structures are steel panel and insulated units with temperature and contaminant control systems, lighting, electricity, plumbing etc., supplied as part of the "package." Temperature may be maintained at plus or minus ½°F. Humidity may be held at plus or minus 2% relative, and high-efficiency filters remove airborne contaminants to 0.5 microns in size. •

Problem: *"Surface of two parts to be joined must be flush. High fastening torque is required, so maximum head contact and high tensile strength is a must. Fastener must be removable . . ."*



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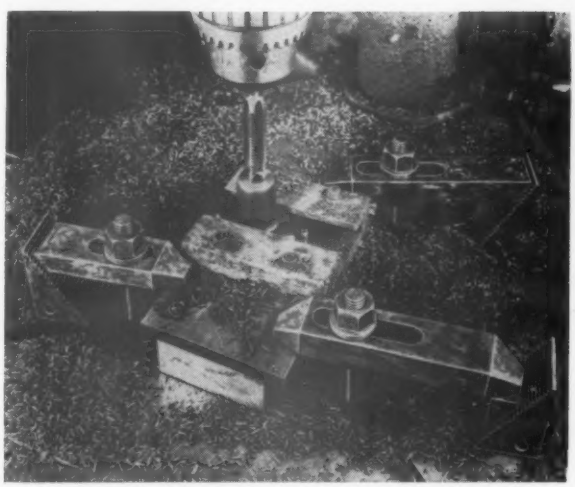
Assembly and Fastening Ideas



Step blocks and clamps cut setup time 75 percent for this small-quantity drilling, tapping and spot facing operation.

CLAMPING TOOLS SHORTEN SETUP TIME

A set of easy-to-mount clamping tools enabled Northwestern Tools, Inc., Dayton, Ohio, to cut setup time and thereby show a profit on a small-quantity order.

In unique fashion, the company put its own line of step blocks and clamps to use in helping to manufacture hand knobs. Holding down a temporary fixture mounted to a Beckett drilling and tapping machine, the tools shortened setup time from an hour to 15 minutes. Each machine tool in the shop is now equipped with its set of blocks and clamps, replacing the old method of using temporary blocks and shims. Standard blocks have a range from ¾″ to 6″ high and 1″ wide, clamps in lengths from 2½″ to 10″ long.

The entire operation, including drilling, tapping and spot facing 50 cast iron special hand knobs, required only 95 minutes, a 50% time improvement.

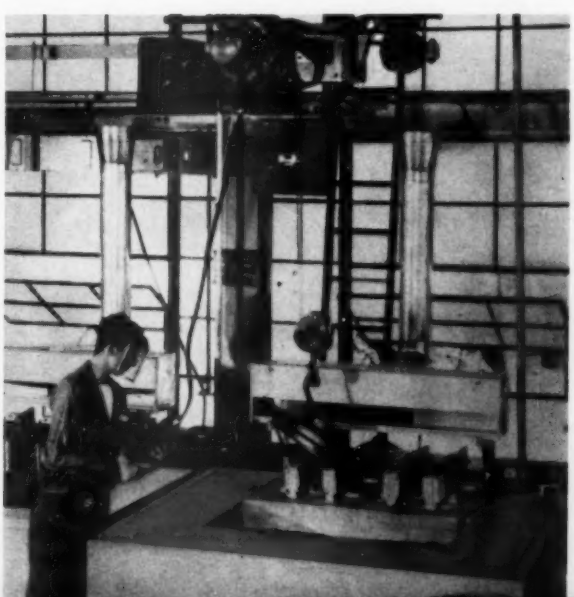
DIP BRAZING REDUCES ASSEMBLY FAILURES

Having trouble in your atmosphere brazing operations with brazing alloys "falling apart"—ending up with no braze at all?

This problem is not uncommon. Certain brazing materials, when held too long at high temperature levels, exceed their melting points before the assembly to be brazed has been heated sufficiently to promote necessary wetting action. The alloy melts out, is lost, and no brazing takes place.

With the meteoric rise of developments in electronics and related industries during recent months, the use of salt bath, or dip brazing techniques as applied to aluminum assemblies, for instance, has increased with pace-keeping speed. The A. F. Holden Co. has designed an electrode-type salt bath brazing furnace which, according to the Detroit firm, has

continued



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been particularly effective in performing the delicate, highly controlled processes required for the brazing of aluminum components into assemblies for electronic instruments, supersonic aircraft and missiles.

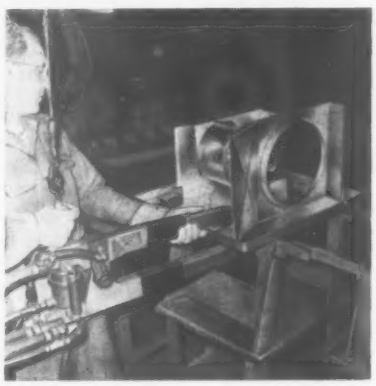
The reported advantages of this method include increased production with rapid rate of heating, reduced time cycles, greater number of pieces processed in shorter periods. Distortion is reduced to a minimum through buoyancy of salt and temperature controlled within plus or minus 2½° F. This also permits use of alloys not otherwise practical.

AIR CONDITIONER LINE AUTOMATED WITH STANDARD WELDERS

In automating its air conditioner chassis fabrication process, the York Division of Borg-Warner Corp. chose to adapt standard welding machines to an assembly line operation rather than to design a highly-complex, fully-automatic machine.

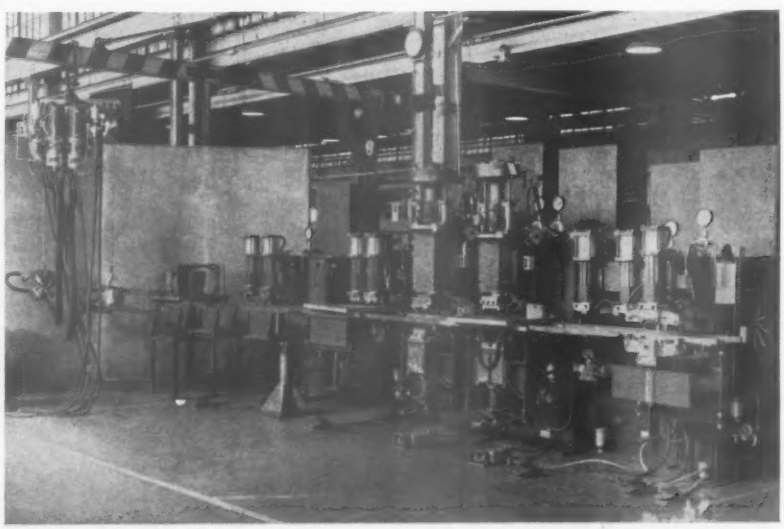
The result is a seven-station line requiring three operators which is cutting assembly cost 34% while turning out 90 units per hour.

Not only was considerable engineering time and cost saved when it was decided work could be done by adapting standard Sciaky machines, but also the line can be quickly changed-over for new models. It handles one-half, three-quarter and one-ton size air conditioners.



A Sciaky portable two-gun welder fastens two clips on pan assembly.

Seven machines are used to projection weld 12 different piece parts to the .080″ galvanized pan. The last machine on the line is a portable unit containing two welding guns to join the plenum condenser to the pan and a stabilizer to the scroll. These gun welds complete operations at station seven. In order to fasten the pan piece parts with their thicknesses ranging from .040″ to .110″, the ratings of the main welding transformers varied from 50 to 250 kva. Throat depths measured from 5″ to 18½″, while pneumatic head



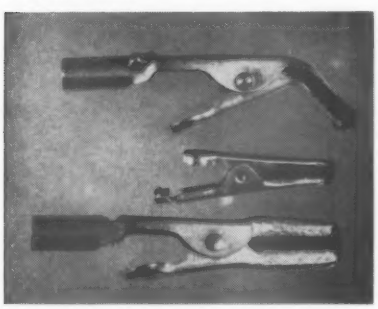
A seven-station resistance welding line is cutting York air conditioner assembly costs 34%. Adaptation of standard machines has proved highly satisfactory.

pressures ranged from 2000 lbs. to 6000 lbs. at 80 lbs. gauge.

Machines at stations one through six are individually actuated through limit switches as the pan is pushed into position.

FELT LINED CLAMPS REDUCE SOLDERING HEAT REJECTS

Boeing Airplane attaches felt-lined metal clamps saturated with water (below) to the lead wire between a joint being soldered and the electronic component being worked on (above). Fewer heat-damaged rejects has been the result.



A simple, safe and effective method developed at Boeing Airplane Co., Seattle, Wash. for soldering heat-sensitive electronic components to circuit cards has resulted in a marked decrease in rejections due to heat damage.

In soldering electronic components to circuit cards, heat is conducted along the lead wire from the soldered joint to the component. Unless some precautionary measure is taken, sensitive components can be damaged by the heat. To prevent such damage, Boeing designed a "heat sink" consisting of a standard metal clamp lined with felt. The felt is saturated with water and the clamp attached to the lead wire between the soldered joint and the component. Heat traveling along the lead wire is dissipated by evaporation of water from the felt, protecting the component •

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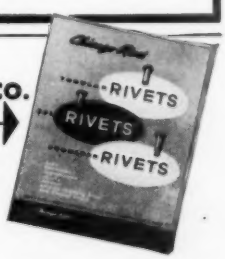

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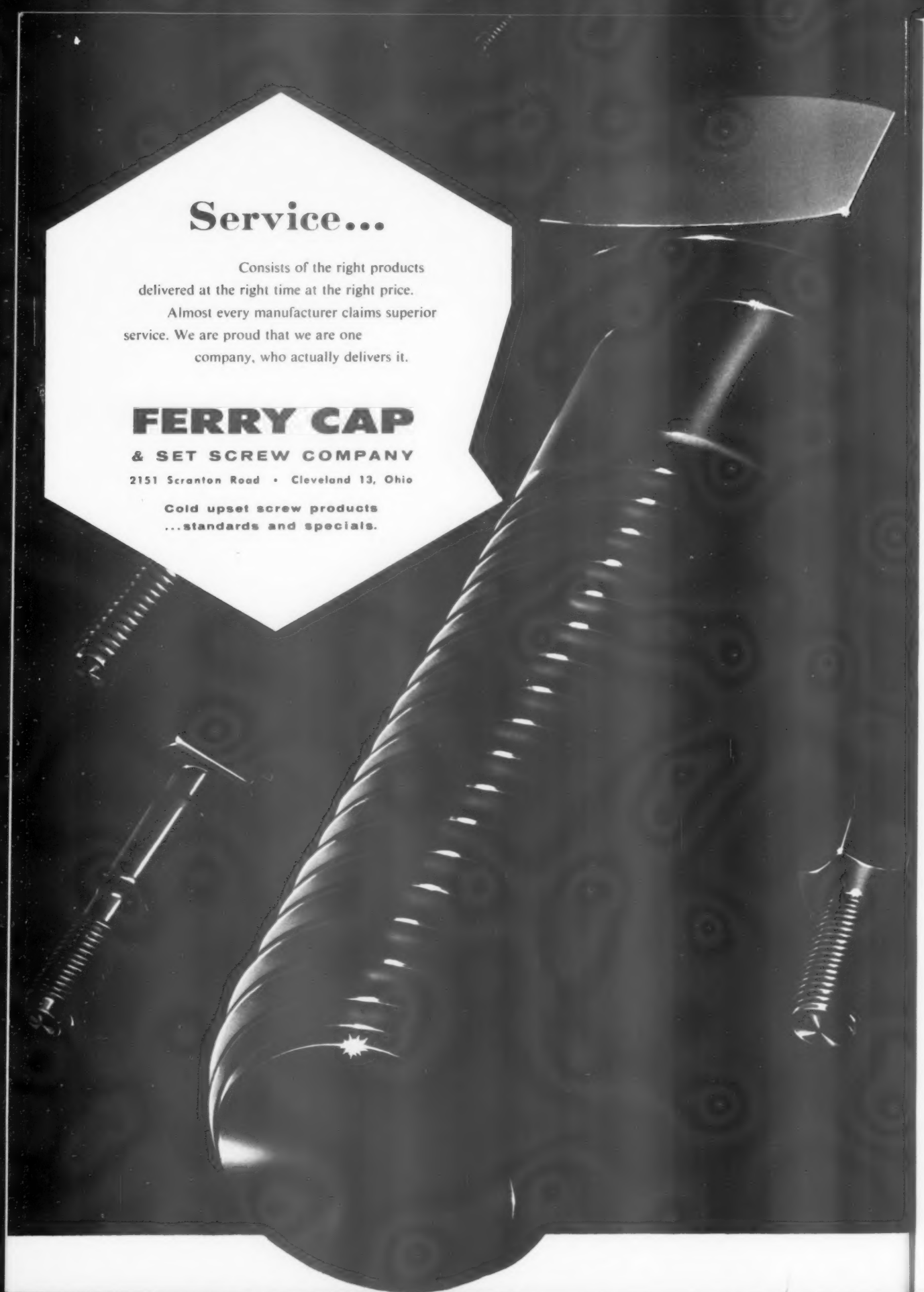
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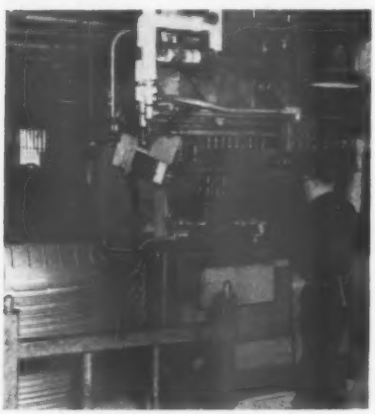
AMERICAN MOTORS VARIES SPOT WELDING METHODS FOR EFFICIENT RAMBLER ASSEMBLY

Over 8000 individual welds are being used to construct the 1959 Rambler bodies coming off the assembly line at American Motors Corp. plant in Milwaukee.

The new cars are fabricated with a variety of welding methods—gas, arc and resistance.



Rambler instrument panel is multiple spot welded by an electronically controlled, automatic machine.

Resistance welding, both single and multiple spot welds, is most frequently used.

The practical method of assembly is accomplished by clamping lapped edges of metal between two water-cooled copper alloy or copper tungsten electrodes with a small tip area. Electrical currents up to 12,000 amps., are passed through the electrodes for a short time with 400 lb. electrode force. The current melts the metal at the point covered by the tip area and fuses it under pressure into a strongly bonded weld.

At American Motors, single welds are accomplished with portable welding guns easily manipulated by the operator to weld sections of the deck, frame or roof of the Rambler. More intricate pieces, such as the fire wall or dash assembly, requiring many welds in a small area, are fastened on large multiple spot welding machines. These machines are

Single spot welds are made by portable units along the American Motors assembly line.

equipped with as many Tuffaloy welding tips as necessary—either straight, swivel, bent or otherwise specified to be manufactured by the Air Reduction Sales Company.

Resistance welding tips used on the multiple spot welding machines can be quickly interchanged for various portions of the assembly, or adapted to weld similar parts of the different models.

POWER TOOL MAKER CUTS MOTOR WEIGHT, MACHINING COSTS BY BONDING DIE-CASTINGS

Metal to metal adhesive bonding has solved both a design and production problem in the manufacture of pneumatic tool motors at Albertson & Co., Sioux City, Iowa.

A high-strength thermosetting film adhesive called AF-13, developed by 3M's Adhesives, Coatings & Sealers Division, is used to bond a powdered iron disc to an aluminum die-casting in the making of rotor end plates for portable power tool motors. The resulting bond is so strong that when excess force is applied, the powdered metal component will fail before the adhesive joint gives away.

Die-cut film adhesive (center) bonds powdered iron disc (left) to aluminum casting (right).

This bonding method permits the use of the proper balance of wear-resistant and light-weight metals, reduces weight of the finished product and cuts machining costs.

At one time the end plates were machined from solid bronze. Because of the part configuration, which includes much channeling and ducting for passage of air into the motor, machining was expensive and required considerable time.

continued

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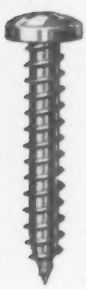

at the Phillips recess — developed by American — for consistent depth and dimension. Without these, both fasteners and your product are damaged by cam-out, burring and distortion. Those costs come out of your profits. American gives you this mark of quality because its dies are designed to maintain this quality at the end of the run as well as the beginning.

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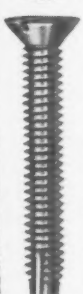

at slotted fasteners that are cut clean and true to the head size. Poor slots give you poor driver engagement . . . take longer to drive, cost more in labor . . . and it all comes out of your profits. And remember to check the slots at the end of the run as well as the beginning, for only quality equipment and attention to detail can give you consistent quality . . . which you get from American.

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The face of the end plate which carries the thrust of the rotor at speeds of 2700 rpm must also provide a wear surface. After investigation, Albertson engineers found that the combination of powdered iron and aluminum gave the best overall wear and weight properties.

A thermosetting film adhesive was selected because the dry film adhesive can be die-cut to conform to the part configuration. This provides uniform adhesive thickness throughout the joint and good control of the bond.

To begin operations, the film is placed on the casting. Two positioning plugs are inserted through the casting and film and the disc is located on the plugs. Fifteen end plate assemblies are then placed on a rod-like rack. Bonding pressure of 35 psi is applied by means of a torquing bolt on the end of the rod.

One requirement is that all surfaces must be flat, making it necessary to mill the aluminum castings.

The assemblies are oven cured at 350° F. for one hour and cooled. Then the edges of the casting are machined and the face of the disc is lapped. Finally the plates are immersed in an oil bath for permanent lubrication.

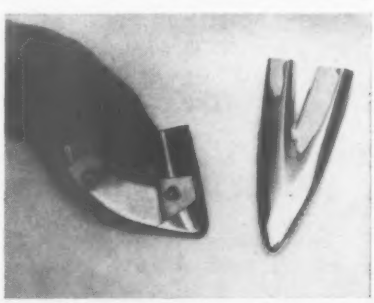
An adhesive film is being placed between iron disc and aluminum casting prior to bonding.

End plate assemblies under pressure are cured in an oven at 350° for one hour.

AUTO TRIM ATTACHED BY PROJECTION WELDED FASTENERS

Fabricating and attaching automobile trim, once an 11-step operation, has been cut to three steps by a new fastening method.

The Primeweld Corp. of Dearborn, Mich. has not only speeded the process by resistance welding stainless steel fasteners to stainless steel stampings, but also does the job without leaving any weld marks on the moulding. This is done in the transformer—low voltage, high amperage, enough current to join the metals but not enough to distort or discolor.



A low voltage, high amperage method of welding fasteners to Allegheny Ludlum stainless steel automobile trim has speeded assembly, eliminated discoloration on the parts.

In addition, the wide flange usually on the moulding can be eliminated, saving on material. Primeweld engineers see the greatest advantage in time savings and die costs, claiming that where it would take 12 weeks to tool for a new stainless steel moulding, this method would require only four weeks.

There is no limit to the size of the parts than can use the method.

continued

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On parts such as these, Progressive's cold forming method is superior to other fabricating techniques. Scrap is eliminated because the metal is formed into shape, not machined away as expensive scrap. Primary and secondary operations may be combined more readily to effect savings in machine time and between-machine materials handling. Work quality is just as you want it — we won't let it out unless it is.

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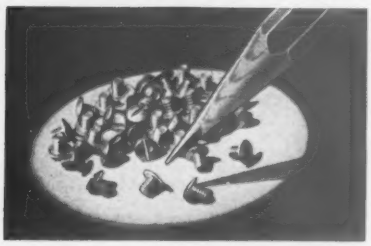

Another example of how Hubbell Cold Heading produces Better Parts at Faster Speeds, at Lower Cost

THE PART:
Special 1-64 Miniature Binding Screw

THE MATERIAL:
18-8 High Tensile Stainless Steel

THE METHOD:
Hubbell Cold Heading in place of screw machining

THE RESULT:
a. Production increased from original rate of 7000 pc. p.d. to cold heading rate of 40,000 pc. p.d.
b. Cost reduced 45%
c. Finer Quality—More Economical Production
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Hubbell Cold Heading may provide equally dramatic results for you. Whether it is presently cold headed or not, send blueprint of part or sample for analysis and estimate.

HARVEY HUBBELL, Inc. *Machine Screw Dept.*
Bridgeport 2, Connecticut

Kindly estimate on the enclosed Sample (Blueprint). Quantity _____

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Use postpaid card. Circle No. 217

Maximum gauge is .090, minimum .022. Most of the work has been done on Type 430 stainless.

TURNING, VIBRATING DEVICE IMPROVES C-V QUALITY CONTROL

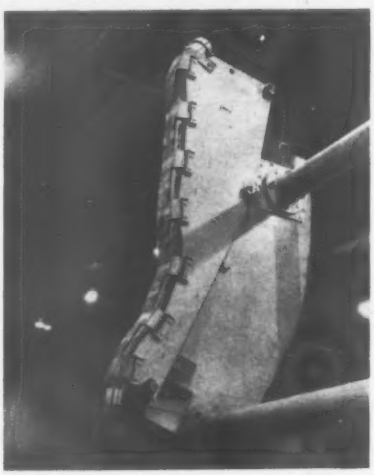
Revolving slowly in a huge fixture like chickens on a spit, F8U Crusader jet fighter plane fuselages are providing a unique sight these days for visitors to the Chance Vought plant in Dallas, Texas.

Rotation in the "roll-over" fixture and simultaneous "shaking" by a mechanical vibrator provides insurance against lodging of waste material in controls during flight.

Designed by the plant's tool design group, the fixture features contour pressure pads on either side of the forward fuselage kept in tight contact with the aircraft skin by short lengths of 2½" fire hose filled with water at pressure of 20 lbs. psi.

The fuselage, minus the tail section, is lifted into the roll-over fixture after the two top sections of the rotation rings have been removed. Four rubber pads hold the rear part of the fuselage in position at 35 lbs. pressure psi. Flush pin gages indicate correct pressure on the plane's skin and bulkheads. Counterweights at the top of the circular contour rings help balance the plane in the fixture.

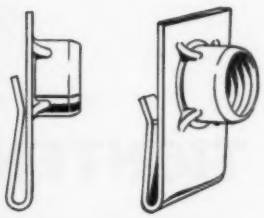
A gear train and chain-sprocket transmission assembly, driven by a one hp motor, provides rotational power at an estimated ratio of 90-1. The fixture makes one revoution in approximately 10 seconds. The forward and aft contour rings ride on free-rolling, bearing-mounted wheels.



Removable contour pads cushioned with fire hose hold the plane fuselage in place during "housekeeping" job.

F8U-1 Crusader fuselage is picked out of fixture on completion of roll-over to dislodge bits of scrap at Chance Vought plant.

DOT makes J NUTS with a difference



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- LOW COST
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It takes a little extra care in the drawing operation to make really reliable J-nuts in volume but it's well worth the trouble. It reduces internal strains in the barrel so that DOT J-nuts stand up to working loads considerably better than the average fastener of similar construction.

Available in three thread sizes (5/16″-18 and 24, 1/4-20) and to fit three ranges of material thickness (.030″ to .065″), DOT J-nuts are made of carbon steel. They hold themselves in place over stamped holes so that preassembly is practical in cases where the actual bolting operation comes at the end of a series of other operations.

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CARR FASTENER COMPANY

Division of United-Carr Fastener Corporation, Cambridge 42, Mass.

MAKERS OF DOT FASTENERS

TIGHTENING THREADED FASTENERS

This first of two articles is concerned with shear and tension, types of threaded fasteners, plus consideration for torque and its measurement

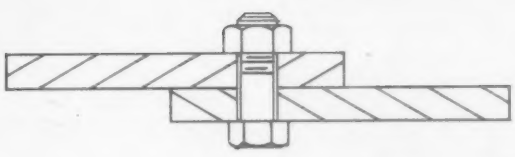


Figure 1—Single shear loading.

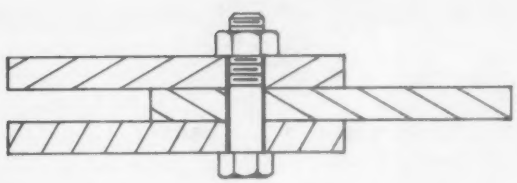


Figure 2—Double shear loading.

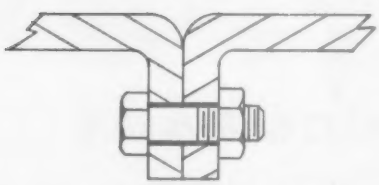


Figure 3—Tension loading.

by **Paul Van Sittert**
Chief Development Engineer
The Rotor Tool Company

With the enormous number and variety of threaded fasteners used in industry, the incessant striving for lower costs demands that in most applications these fasteners be tightened with power tools.

Threaded fasteners are usually used to attach two or more members of an assembly to each other. The types of joints commonly used between the members can be divided into two general classifications.

In the first classification, the fastener is subjected to shear loading so that the fastener tends to be cut by two or more members, just as fabric would be cut between the blades of a scissors. This action may be in single shear (Figure 1) where only one section of the fastener is under shear, or it may be in double shear (Figure 2) where two different sections of the fastener are subjected to this shear.

The second broad classification is one where the fastener is loaded in tension (Figure 3), and prevents the two sections from being pulled apart.

At first glance it would appear that the fastenings used in shear loading would not need to be tightened very much since the size of the fastener, and the number of fasteners used, largely determine the load-carrying capacity of the joint. This, however, is not altogether true. If the fastener clamps the members tightly together, the resulting friction between their surfaces greatly increases their capacity to carry load.

When the fastener is loaded in tension, its behavior is even more complex. The service loads on most joints do not remain constant, but fluctuate through considerable amounts, sometimes even changing direction. This is what usually occurs when the joint is subject to vibration. This fluctuation tends to loosen the fastener and destroys its effectiveness.

Another consequence of fluctuating load may be even more serious. To fully understand this, we must review a few simple engineering principles.

When a tension load is applied to a member, it elongates elastically so that the amount of stretch

Part 1 of two-part article concerned with "power tools for tightening fasteners"

is proportional to the load until the material reaches a point known as its yield point or elastic limit. Further increase in load will produce additional deformation of the material from which the member can never recover. Still further increase in load will cause the piece to break. This cycle is illustrated in Figure 4. The straight line intersecting the axis represents the elastic deformation zone. Where this straight line begins to become a curve is a point at which the material begins to yield plastically. Plastic stretch continues until the piece pulls apart.

Members can fail in tension, however, without being stretched to their ultimate strength. This is the case when the breakage of the part is due to a fatigue failure. Figure 5 is a typical curve showing the number of times a piece can be loaded in a particular stress before failure. Where the curve intersects the vertical axis indicates that one application of the ultimate stress breaks the piece. Smaller stresses can be applied more frequently before failure occurs.

When the stress has been reduced to a value, usually about half of the ultimate, it can be applied an infinite number of times without producing a failure. This point is known as the endurance limit of the material.

Fluctuation in the stress should be kept to a minimum. Small fluctuations cannot be counted as repeated applications of the stress and consequently do not contribute toward fatigue failure. Also, if the stress can be kept below the endurance limit, failures can be avoided.

PRE-LOADING PREVENTS LOOSENING

Thus, the best way to prevent loosening or breakage of the fastener and to keep its load as steady as possible, regardless of fluctuations in the service conditions, is to impose a pre-load by initial tightening such that the tension in the fastener is somewhat under its yield strength.

Figure 6 illustrates the manner in which this pre-load acts. When the fastener is tightened against the resistance of the spring—before the load "W" is applied—the spring pressure acts as the pre-load which holds the surfaces of the two members together. When load "W" is applied in any amount, less than the pre-load of the spring, it reduces the clamping pressure between the two members,

Continued

The second article, to appear in the June issue, will be concerned with the different types of power drivers available for use on the assembly line

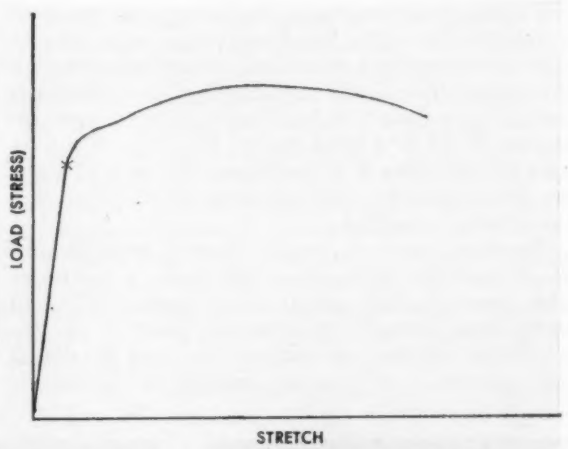


Figure 4—Cycle in elastic elongation.

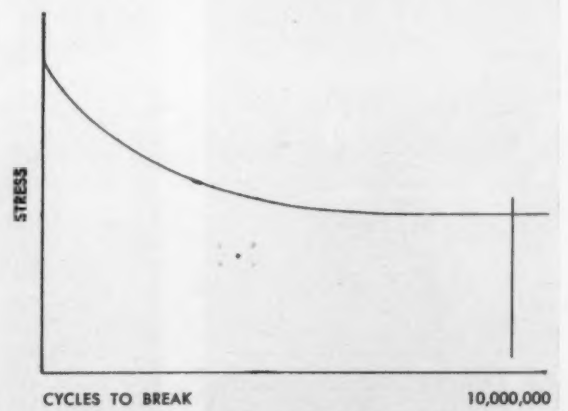


Figure 5—Curve of stress-loading to failure.

but does not increase the tension in the fastener, unless the spring pre-load is exceeded. This action is what always occurs when a fastener is tightened, the elastic stretch being inherent in the fastener itself. Thus, we see the importance of a proper pre-load in the fastener, and know the factors which determine this amount.

TYPES OF THREADED FASTENERS

Fasteners themselves may be divided into three broad groups. First of these is the free-running group (Figure 7). It includes all kinds of machine and cap screws and nuts, and is characterized by small resistance to rotation until the fastening is thoroughly tightened.

The second group is the cutting type of screw (Figure 8). It includes self-tapping screws, sheet metal screws and wood and lag screws. Sheet metal screws are made in two different styles, one of which is tapered and the other which is nearly straight. The tapered type offers increasing resistance to rotation during driving, whereas the nearly straight type offers high resistance to rotation until the point and threads break through the sheet, and much lower resistance thereafter until the head is snugged up tight. Wood and lag screws usually offer increasing and continued resistance to rotation throughout their entire travel. All of these fasteners should be installed in lead holes of the proper diameter. If the lead holes are too large, the effectiveness of the fastener is destroyed. If the lead holes are too small, the fasteners may twist off during the driving operation.

The third group is the self-locking type (Figure 9). It includes stop nuts which have a plastic or fibre insert through which the threads of the bolt must force themselves. Another example of this type are lock-nuts of which a portion is slotted and crimped to frictionally engage the threads of the bolt. Some bolts and nuts have fibre or plastic plugs inserted in radial holes in the metal, so that the mating part must cut threads through this plastic or fibre plug during the assembly operation. Still other fasteners fall into this same group, and more are being added every day, but most are similar in function and in operation.

When driving threaded fasteners with power tools, the most important consideration is torque. For our purposes, we shall think of torque as the force tending to cause rotation. In any particular job, there is a very definite relationship between the torque applied to the fastener and the tension developed in the fastener, but this relationship depends upon a number of factors. One of these factors is the diameter of the bolt. Another of lesser importance is the pitch of the thread. The third is the friction, either between the head of the bolt or the nut and the workpiece, and between the mating threads.

HOW MUCH TORQUE IS APPLIED?

It has been estimated by some engineers that of the torque applied to a threaded fastener, 50% goes into collar friction between the face of the bolt head or nut and the workpiece, 40% is lost in thread friction. Only 10% goes to produce the desired tension in the bolt shank.

In the screw-cutting group of fasteners, the material being fastened exerts considerable influence in the torque required. Self-tapping screws drive harder in steel than in aluminum, just as wood screws drive harder in oak than in white pine. Also, sheet metal screws may require excessive torque to drive if lead holes are slightly undersize.

Only the smaller sizes of fastenings tend to twist off while driving. This is because the torsional strength of a fastening increases as the third power of its diameter, whereas the cross-sectional area on which its tensile strength depends increases only as the second power of the diameter.

Specifications for the permissible variations in the

This machine indicates bolt tension on top-side dynamometer scale.

The scale on this device reads directly in bolt tension.

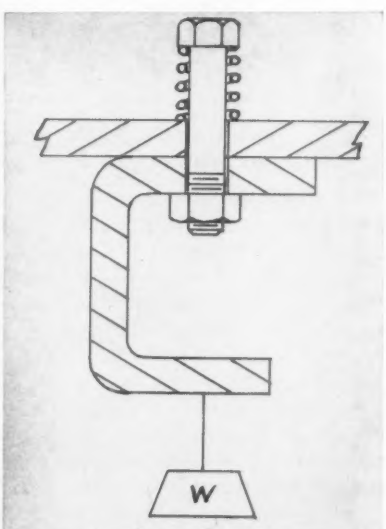
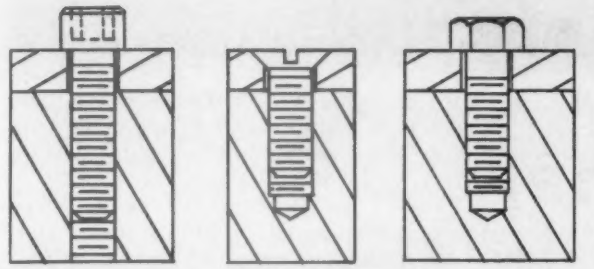


Figure 6—Illustration of manner in which pre-loading acts.



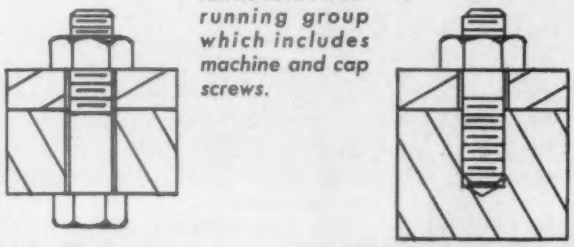


Figure 7—Five examples of fasteners in the free-running group which includes machine and cap screws.

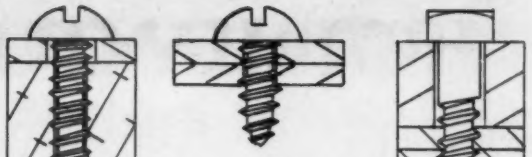


Figure 8—Three examples of cutting-type screws.

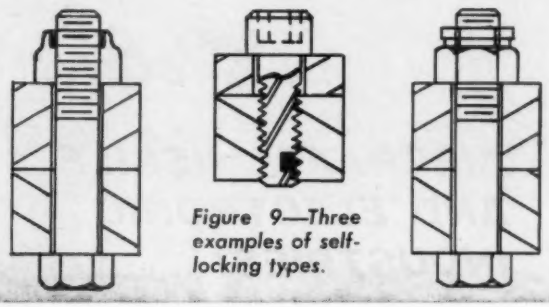


Figure 9—Three examples of self-locking types.

torque tightness of threaded fasteners frequently bear little relation to the actual needs of the application. We have seen that the tension in the assembled fastener should be somewhat below the yield point, but not too far below to insure good holding power with minimum danger of fatigue failures. On the other hand, the material and heat treatment employed in the manufacture of the fasteners is subject to considerable variation in addition to the dimensional manufacturing tolerances. Since such a small percentage of the applied torque goes into producing tension in the fastener, inevitable variations in the friction, both at the faces and on the threads, may cause wide variations in the tension for identical torque values.

Specifying a $\pm 2\%$ variation in the torque of a threaded fastener whose material may vary $\pm 10\%$ in yield strength and whose friction may vary $\pm$ another 10% in driving, seems little short of silly. The only justification for specifying torque and its permissible variation is that it is much easier to measure and apply than is bolt tension. Many manufacturers establish torque standards either by test or by calculation and specify $\pm 10\%$ as the acceptable variation from this standard. This is not too difficult to achieve with power tools.

DRIVING SPEED VS. FINAL TIGHTNESS

One feature of power tools in applying torque to threaded fasteners which creates considerable confusion is the rate at which the fastener approaches its final tightness. With free running bolts or cap screws, clamping rigid members in metal-to-metal contact, the progress from finger tight to full tight may be accomplished in a quarter turn or less of the screw. This type of application is sometimes referred to as "a hard job."

If the fastener approaches its final tightness less rapidly—for example, by squeezing a gasket, pulling together buckled plates, or clamping wood or rubber—it is sometimes called "a draw job" or "a soft job" or a "pull-up job." Bear in mind that the rate at which the fastener approaches its final torque is the criterion by which the job is to be judged, since a bolt and nut through a solid steel block can exhibit all the characteristics of the so-called "soft job" if the head of the bolt turns slightly at the instant the nut approaches its final tightness. The importance of this factor must not be underestimated because the degree of hardness or softness of the job exerts a profound influence on the selection of the proper power tool to attain the desired degree of tightness.

There are two other effects which must be considered in this connection. One of these we can term "relaxation." By this, we mean the change in torque when a time interval has elapsed after tightening. The phenomenon probably arises from the creep or flow in the material being clamped, since it is most pronounced in rubber and certain plastic materials. By measuring the torque in the fastening immediately after tightening and at subsequent time intervals, a curve of this factor can be plotted. It will be seen that after a sufficiently long period of time has elapsed, the curve flattens out and the total amount of relaxation can be estimated. It is possible in this type of fastening to over-tighten the joint and thus allow for the relaxation.

The second situation pertains chiefly to joints secured by two or more fasteners, especially when the joint is somewhat elastic. A typical example is a cylinder head tightened onto a block with a head gasket by ten head bolts. Each bolt in turn can be tightened to its proper torque. After tightening the last bolt, however, it will be found that the first

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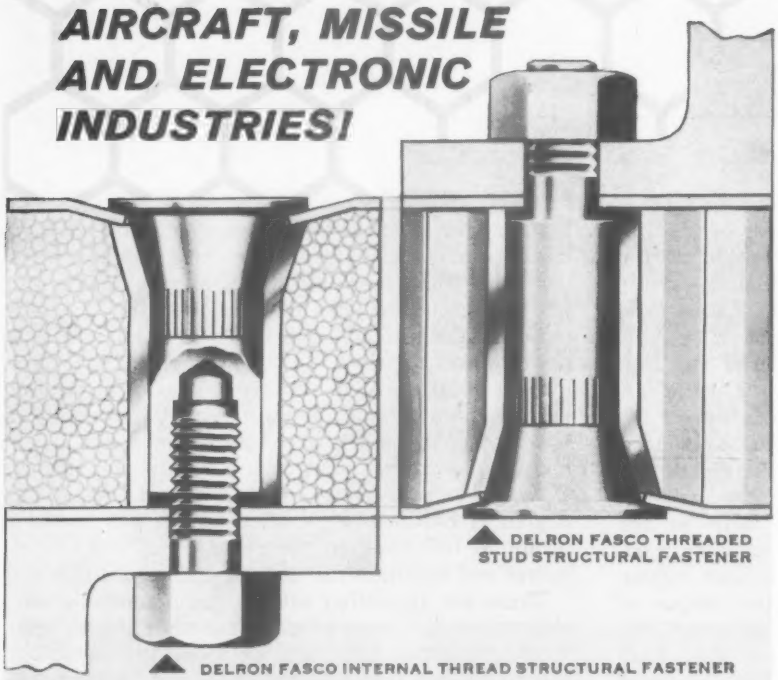

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bolt has lost much, if not all of the torque it had when originally tightened. This, of course, results from the compression of the gasket during the tightening of each bolt in the series.

Two methods have been effective in solving this problem. One method involves selecting a pattern for the order of the tightening of the bolts, so as to best balance tightening loads, and then tighten each fastening in the entire assembly at least twice.

The other method requires the use of multiple tooling so arranged that the torque will remain on the first bolt to reach its required tightness until the last bolt to reach its required tightness, has been completed.

The measurement of torque tightness has been accomplished by several methods, the most common being with the familiar torque wrench, either with the dial or scale type of calibration, or with the click or release type indicator to signal the operator when the desired torque has been achieved.

At least two concerns have manufactured devices in which bolt tension can be correlated to torque. One is Richmont, Inc., whose Livermont analyzer contains a screw and nut which act through mechanical advantage to operate a dynamometer. This portion of the unit is usually used for testing power tools. However, a bolt and nut of the size in question can be inserted in the receptacle furnished, and tightened so that the bolt tension will indicate on the dynamometer scale. At this point, the bolt torque can be read with a hand torque wrench.

The other device is manufactured by the Skidmore-Wilhelm Mfg. Co. It is a simple hydraulic piston and gauge arrangement with appropriate receptacles through which bolts of the size in question can be inserted. The scale reads directly in bolt tension. Torque at the required tension can be obtained by measuring with a conventional hand torque wrench. This unit can also be used in the checking and calibration of power tools. •

Hex socket and Multiple-Spline socket

Bristol Dyna-Mites—miniature, No. 0, 1, 2, and 3 button-head and flat-head socket screws

Here's news for designers of precision equipment—electronic components—missile parts

Precision Bristol button-head and flat-head socket screws are now available in smaller standard stock sizes than ever before—down to No. 0, in heat-treated alloy and stainless steel (other metals on special order).

Bristol is the first to offer these tiny button-head and flat-head socket screws, aptly named Bristol "Dyna-Mites," as stock items—thanks to increasing demand from manufacturers of a wide variety of precision equipment such as electronic components and subassemblies, computing machines, cameras, and scientific instruments, and other precision products of every kind. Larger sizes (to ¾" for flat-head and ⅝" for button-head) have been standard items with Bristol for many years.

The new button-head and flat-head screws will supplement Bristol's already extensive line of Dyna-Mite socket cap and set screws in sizes down to No. 0, 1, 2, 3—long a Bristol specialty. They feature the same superior holding power under shock and vibration, can be wrenched up tighter and loosened, time after time, without damage to the socket. And they're made under the same rigid, exhaustive quality-control requirements.

Get data on these tiny Bristol Dyna-Mite button-head and flat-head socket screws from your authorized Bristol socket screw distributor, or write to the address below. A.9.3A

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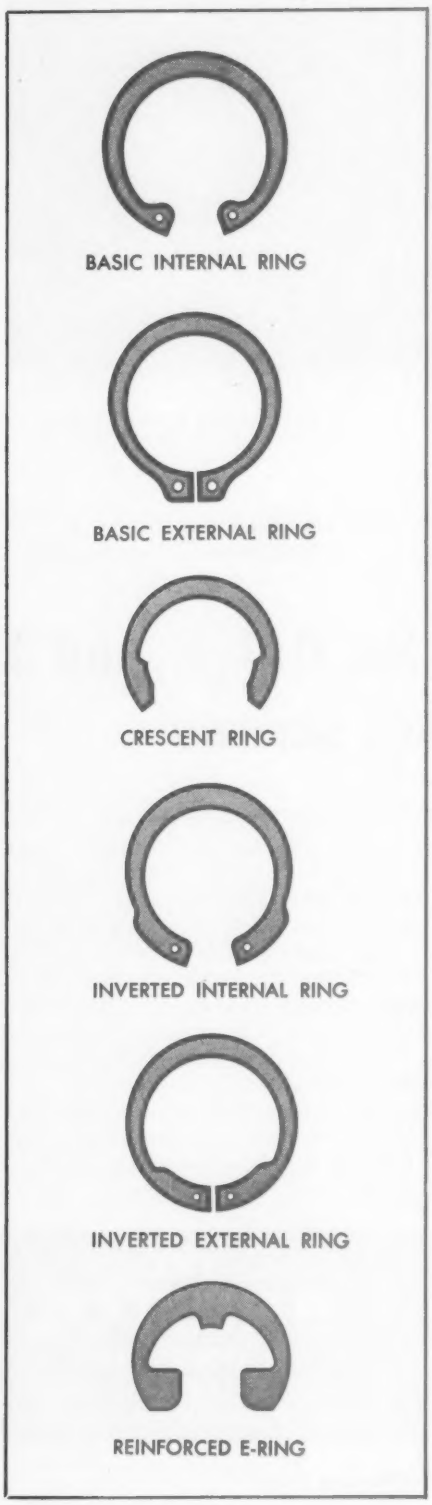
THE DESIGN AND APPLICATION



A description of basic types of stamped rings and special rings designed for specific fastening problems. How retaining rings may be used to speed assembly, reduce costs and help improve product design

by **Dr. Oswald Kolbert**
Technical Manager
Truarc Retaining Rings Division
Waldes Kohinoor, Inc.

While wire snap rings have been utilized as retainers ever since the latter part of the 19th Century, the use of stamped retaining rings is a relatively new fastening technique.

The first basic types—an "internal" ring for use in housings and bores, and an "external" ring for application on shafts and studs—were introduced in this country in 1942. They were developed originally for use in aircraft. Demand for these fasteners in other industries, however, has led to the development of a great many different ring types and sizes designed to satisfy a wide range of assembly and fastening requirements.

Today, stamped retaining rings are used in virtually every manufacturing industry. Applications range from miniaturized electronic systems to massive earth-moving equipment; from automobiles and business machine to complex components for guided missiles; from such commonplace items as door knobs to top-secret atomic energy installations.

Because most design and production engineers work in highly specialized areas, their contact with other industries often is limited. The same fastening problems, however, are encountered in many diverse manufacturing fields. For this reason, a review of the purpose and function of various types of stamped retaining rings—and an explanation of how the rings have been used in different industries to improve product design and reduce manufacturing costs—may be of value.

LOCATING AND LOCKING DEVICES

While retaining rings often serve more than one purpose in an assembly, their primary function is to provide a removable shoulder for accurately locating, retaining, or locking components on shafts and in bores and housings. The most widely used

OF RETAINING RINGS

ring types are seated in annular grooves which are pre-cut before the ring is installed. Self-locking rings which do not require grooves also are available and will be discussed later.

Stamped rings are characterized by a tapered radial width which decreases symmetrically from the center section to the free ends. The tapered construction permits the rings to remain circular after they have been expanded for assembly over a shaft or compressed for insertion into a bore or housing. This constant circularity assures maximum contact surface with the bottom of the groove—an important factor in achieving high static and dynamic thrust load capacities. Another characteristic of the stamped ring is that holes are provided in the lugs at the free ends. The holes are designed to accommodate retaining ring pliers which facilitate assembly and disassembly of the rings.

Most rings are stamped from high-carbon spring steel. For special applications, aluminum, beryllium copper, phosphor bronze and corrosion-resistant stainless steels also are available. Standard sizes range from approximately ⅛″ to 10.0″ in diameter, although rings as large as 20″ in diameter have been produced for special applications. An idea of the number of available standard sizes may be gathered from the fact that there are more than 30 diameters produced between ⅛″ and 1.0″.

INTERNAL RINGS

Retaining rings generally are grouped by function. Of the internal types—i.e., those used in bores and housings—the basic ring is perhaps among the best known and most widely used. The ring incorporates the tapered construction mentioned earlier and, like other axially installed rings, has plier holes to facilitate handling during assembly and disassembly.

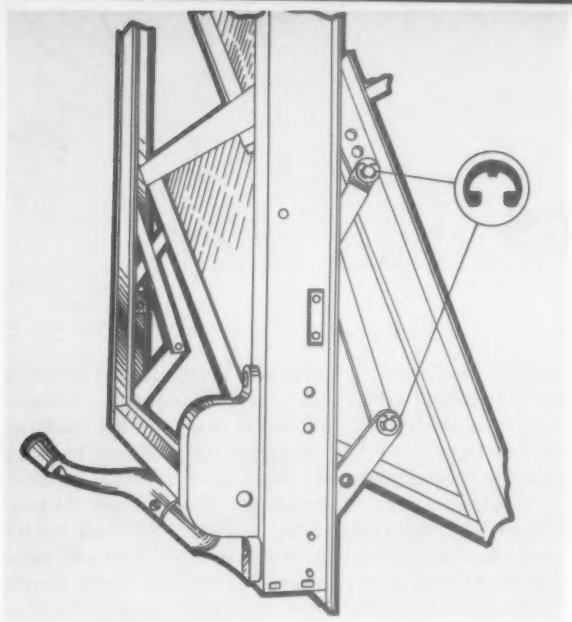
The fastener is designed to be seated in a deep groove and is secure against heavy thrust loads. In some sizes, it is manufactured with an extra-large free diameter and gap width to provide even higher thrust capacity. The ring is used widely as a bearing retainer and as a locking device for machine components. In pumps, air cylinders, motors and other applications, it has been employed successfully to eliminate bulky cover plates, flanges, etc. In addition to reducing the size and weight of the units, use of the ring eliminates drilling, tapping, and other machining operations, and speeds assembly and disassembly for field servicing.

The inverted internal ring is similar in construction to the basic type. It differs from the standard ring in that the section height has been increased and the lugs inverted so that they abut the bottom of the groove. While the ring has a somewhat lower thrust load capacity than the basic ring, it provides three distinct advantages: better clearance, a higher uniform protruding shoulder and a more pleasing appearance. Inverted rings are used widely to retain shielded bearings and other components installed where clearance dimensions usually are critical. Other applications include lenses, seals and similar parts having curved abutting surfaces, ball and roller bearings and other components with large corner radii or chamfers; and exposed applications on cameras, office equipment, electrical appliances and other consumer products where appearance is an important factor.

Bowed internal rings are designed for assemblies in which accumulated tolerances cause objectionable end-play between the ring and the retained part. The rings are similar in construction to the basic type except that they are bowed cylindrically around an

continued

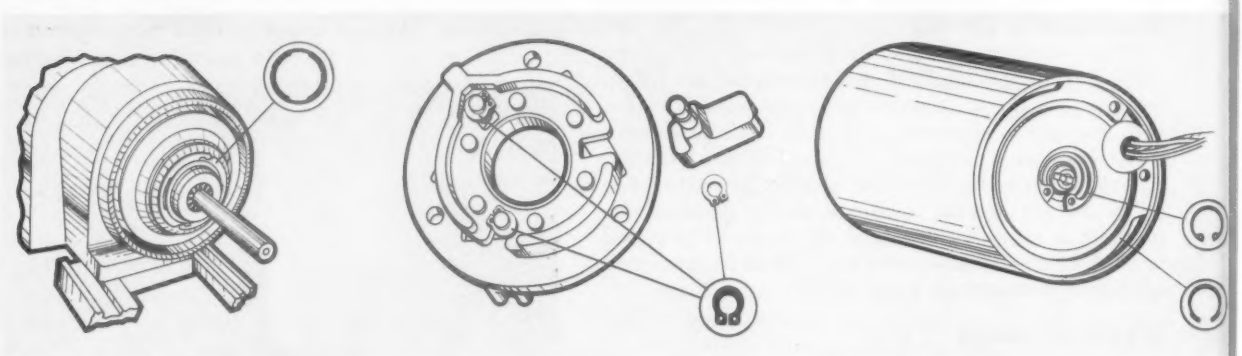
A 10-inch beveled internal retaining ring is installed in the housing of a portable industrial X-ray unit made by Triplett & Barton, of Burbank, Calif. A double-ratchet pliers is used to compress the ring for insertion into the housing. When the ring has cleared the inside of the housing, the pliers are released and the fastener is permitted to snap into its groove.



Reinforced aluminum E-rings secure the hinge pins in the linkage of this louver-type window. The rings provide a large bearing shoulder and are secure against push-out forces developed by rotation of hinge arms. Use of aluminum assures corrosion resistance for exposed application.

axis normal to the diameter bisecting the ring gap. The bowing makes it possible for the rings to provide resilient end-play take-up in an axial direction while maintaining a tight grip against the bottom of the groove. Bowed rings are used widely to preload bearings, provide spring tension on adjustment devices and prevent rattle in machine linkages. They are useful also for salvaging assemblies designed originally for flat rings where the groove has been cut too wide.

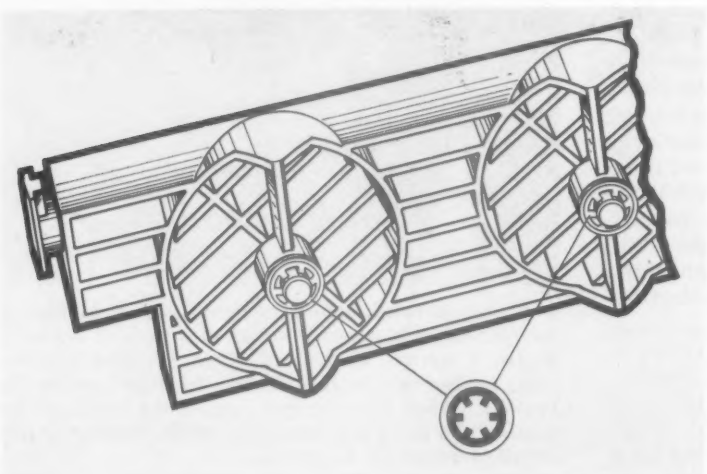
Beveled internal rings are designed to provide rigid end-play take-up. The rings have a 15° bevel on the outer edge and are installed in grooves having a corresponding bevel on the load-bearing wall. The beveled ring-and-groove combination provides a wedge action between the ring and the abutting face of the retained part. When end-play is present in the assembly, the fastener seats more deeply in the groove, automatically compensating for accumulated tolerances or wear in the parts being retained. Beveled rings are used widely in automotive trans-



A two-part interlocking ring is used to lock the handwheel assembly on the impact sleeve of this spindle-nose lathe chuck. The fastener is balanced to withstand high rotational speeds.

Grip rings secure the adjustment slides to base of this arrow fletching machine. The rings may be seated at any point on the studs to compensate for tolerances in the cast parts.

This drive motor for airborne instruments uses a number of rings to simplify design and eliminate machined shoulders used in original design. Internal rings at each end help position and retain the bearings. An inverted ring secures the endplate, locking the entire assembly in the housing.



This air-conditioner vent illustrates applications of push-on-type circular self-locking rings which do not require grooves. The rings lock the adjustable air baffles against axial displacement. They are installed over bowed washers which provide sufficient spring tension to hold adjustment settings when the baffles are turned. The rings accommodate tolerances in the molded plastic studs, and blend in neatly with the baffle design.

missions, pressure pumps and other applications where a tight seal is critical.

EXTERNAL RINGS

External rings—i.e., those used on shafts, studs, pins and bosses—fall into two major categories: axially-assembled and radially-assembled types.

The axial group includes basic, inverted, bowed and beveled retainers similar in construction to the internal types. The rings differ from the internal styles in that the lug positions are reversed and the inner circumference of the ring abuts the bottom of the groove. The fasteners are expanded for assembly and disassembly, in contrast to the compression required for the internal types.

Axially-assembled external rings are used extensively as positioning and locking devices in automobiles, household appliances, machine tools and many other consumer and industrial products. They are particularly suitable for linkages, couplings and similar applications where accurate location of components and resistance to impact and vibration are mandatory operating requirements. By eliminating parts and reducing the size and weight of the finished assembly, the rings often make possible design simplifications which would be difficult to achieve otherwise. Elimination of machining operations and sharp reductions in assembly time further reduce manufacturing costs.

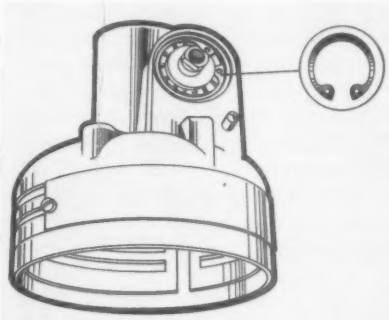
SELF-LOCKING RINGS

All of the axially-assembled internal and external rings described thus far are designed to be installed in grooves. In some assemblies, however, grooving is neither practical nor necessary. Products such as digital computers, recording instruments, cameras and television receivers often require fasteners which are not subject to any sizable static or dynamic loading conditions. Instead, the fasteners must serve merely as positioning and locking devices.

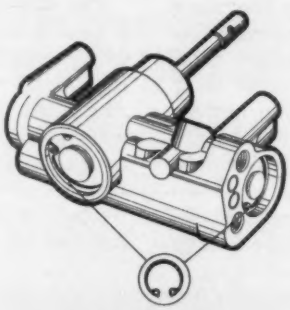
For such assemblies, self-locking rings which do not require grooves offer many advantages. They do not involve any preparatory machining operations and may be installed rapidly with simple tools. They can accommodate wide tolerances in shaft or housing diameter—an especially important feature when the rings are installed on castings and plastic parts—and eliminate the end-play often caused by accumulated tolerances in the retained parts.

A number of self-locking ring types are available.

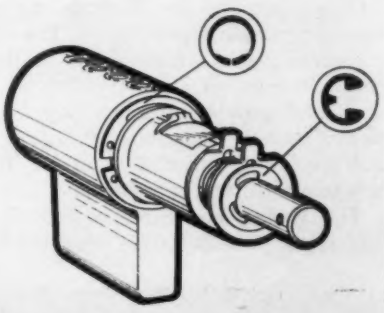
continued



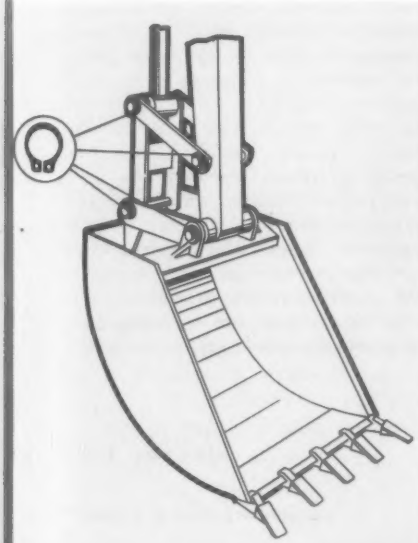
A bowed internal ring is used to preload a radial ball bearing in worm gear drive assembly of movie projector motor. Seated behind bearing, the ring provides shoulder for positioning parts.



Typical application of basic internal rings is illustrated in this hydraulic cylinder. Rings are used to retain seal inserts in cylinder housing. They speed assembly and disassembly.

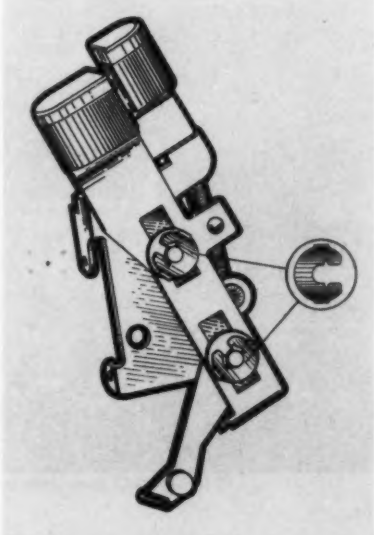


This door lock uses an external inverted ring to couple the cylinder plug to knob-release mechanism. Inverted lugs provide clearance necessary when the cylinder is assembled. E-ring retains spring and washers.



Left: This power shovel linkage is an example of the use of basic external rings. Assembled axially, the fasteners are used to secure the hinge pins. They are seated in pre-cut grooves, and are secure against heavy impacts and vibrations, critical factors in earth-moving equipment.

Right: Here is the shift-slide from an office calculator. Two bowed locking-prong rings retain the components with the right amount of spring tension to assure smooth action without looseness or wobble. The rings lock positively in their grooves and are secure against rotation in the parts.



These include circular fasteners, "grip" rings and various rectangular or triangular retainers. The circular, rectangular and triangular types generally have inclined prongs which bend from their initial position to accommodate the shaft. Most take a sizable permanent set and as a consequence are not reusable following disassembly. The "grip" ring is shaped somewhat like the standard external ring and is assembled and disassembled merely by being spread and snapped into position on the shaft. It exerts a frictional hold against axial displacement and is re-usable following disassembly. The fastener may be installed or removed with retaining ring pliers or with a special grip ring assembly tool.

RADIALLY-ASSEMBLED RINGS

Adjacent parts or other obstructions often prohibit an axially-directed ring installation. Where this occurs, designers should consider various types of stamped rings which may be assembled radially on a shaft directly in the plane of the groove. While such rings have lower thrust load capacities than the axial types, their holding power is sufficient for a wide range of applications.

Crescent rings and E-rings are among the most commonly used radial types. The crescent ring has a tapered radial width similar to the standard axial rings. It remains circular after it is installed on a shaft and provides a tight grip against the bottom of the groove. Because of its narrow section height and uniformly circular shoulder, it is used widely in assemblies where clearance is limited.

The E-ring has three uniformly spaced prongs which grip the shaft. It is designed to provide a large bearing shoulder on shafts of small diameter and is used extensively as a spring retainer. A bowed version of the ring also is available for assemblies in which end-play take-up is necessary.

Of recent development is a reinforced E-ring which provides greater gripping power and higher rpm limits than conventional E-rings.

This fastener differs from the standard E-rings in that it has a heavy web section and tapered bending arms, a construction which develops substantially greater spring pressure with no increase in permanent set. Reinforced E-rings of aluminum, which have more holding power than conventional E-rings made of steel, are used widely for louver windows and other exposed applications where strength and corrosion resistance are important factors.

Two other radially-installed rings which have gained wide acceptance are a two-part interlocking ring and a bowed locking-prong ring.

The interlocking ring consists of two identical semi-circular halves which lock together by means of prongs at the free ends. The ring is balanced to withstand high rotational speeds and is secure against heavy thrust loads. Its uniform, circular shoulder provides an attractive appearance that makes it especially suited for exposed applications.

The locking-prong ring is shaped somewhat like a bowed horseshoe. It derives its name from two prongs which lock the fastener against the shaft when the ring is seated in its groove. To be removed, the ring must first be flattened to permit the prongs to clear the groove. The fastener is designed to be used as a shoulder against rotating parts and has a high thrust-load capacity. Its bowed construction provides resilient end-play take-up and permits the ring to function as a spring as well as a shoulder. The ring

Mechanized Ring Installation

A mechanized retaining ring assembly operation is illustrated in this photo taken in the Leece-Neville plant in Cleveland, Ohio. A radially-assembled crescent ring is used as a locating shoulder on the rotor shaft of a fractional horsepower motor. The rings are supplied in stacks ready for use in the gravity-feed arrangement shown. Operator places a rotor assembly in fixture, and with her left hand pushes a button which actuates an air-operated arm. The arm has an applicator blade which grasps the last ring in the stack and pushes it into position in the groove on the rotor shaft. The arm is withdrawn automatically after ring is installed.

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Portable C

SCALE: INCHES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

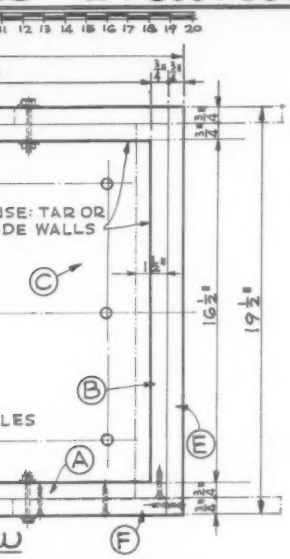
TOP...VIEW

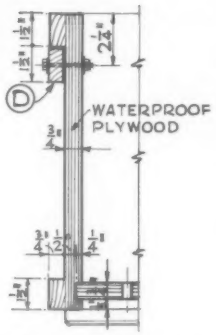
SIDE..VIEW

ALTERNATE: USE SOLID RED
OR CYPRESS ¾" THICK

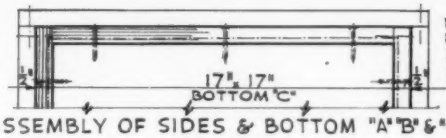
HAGER DESIGN STUDIO 1-3-59

e Planter





CONSTRUCTION DETAIL



ASSEMBLY OF SIDES & BOTTOM "A" "B" & "C"

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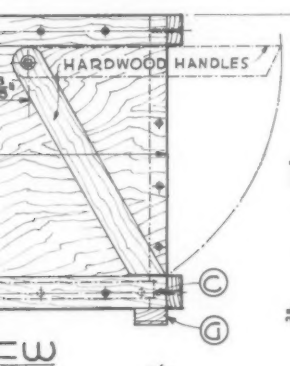

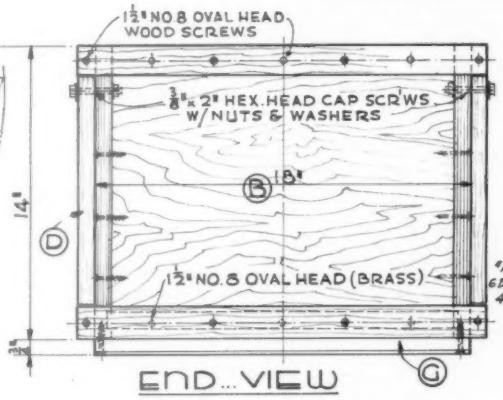

END... VIEW

BILL..OF..MATERIALS			
2 PCS	¾" x 14" x 18"	SIDES	"A"
2 "	¾" x 14" x 16½"	ENDS	"B"
1 PC.	¾" x 17" x 17"	BOTTOM	"C"
4 PCS	¾" x 1½" x 13"	HANDLES	"D"
4 "	¾" x 1½" x 19½"	TRIM	"E"
4 "	¾" x 1½" x 18"	"	"F"
2 "	¾" x 1½" x 18"	SKIDS	"G"

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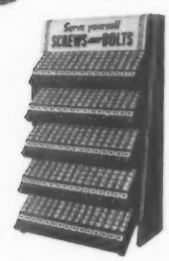

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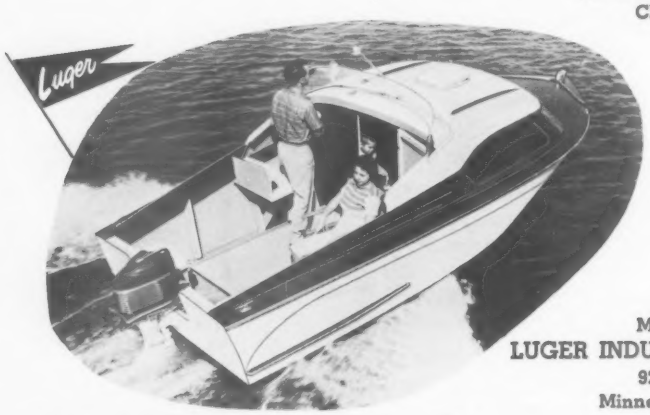

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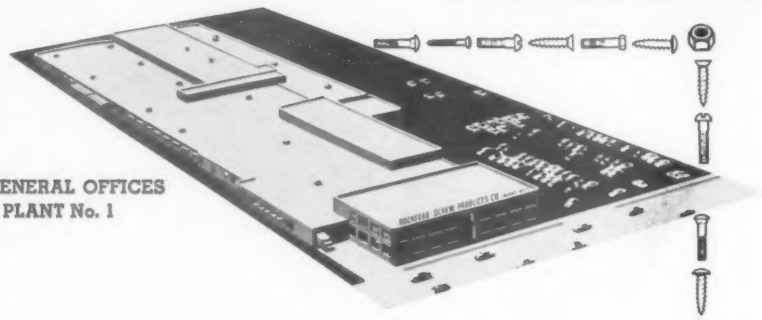

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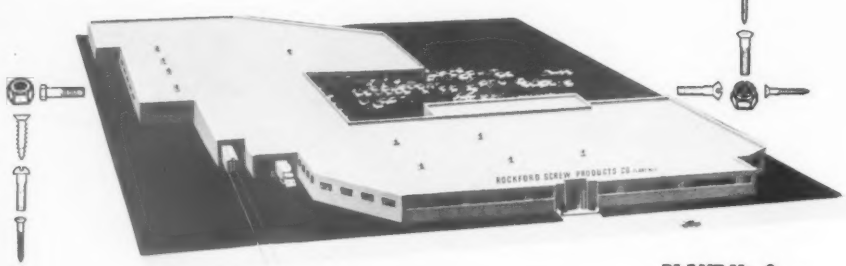
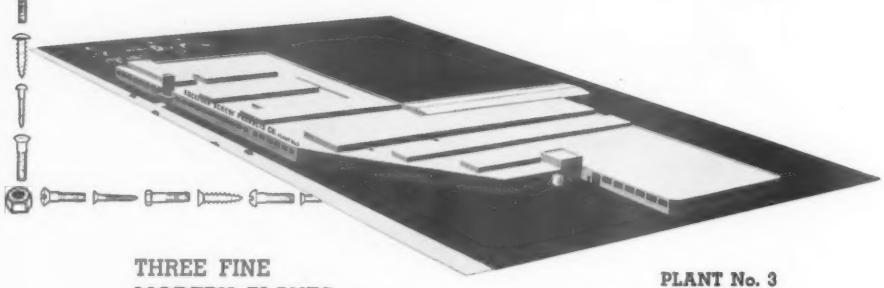


PLANT No. 2



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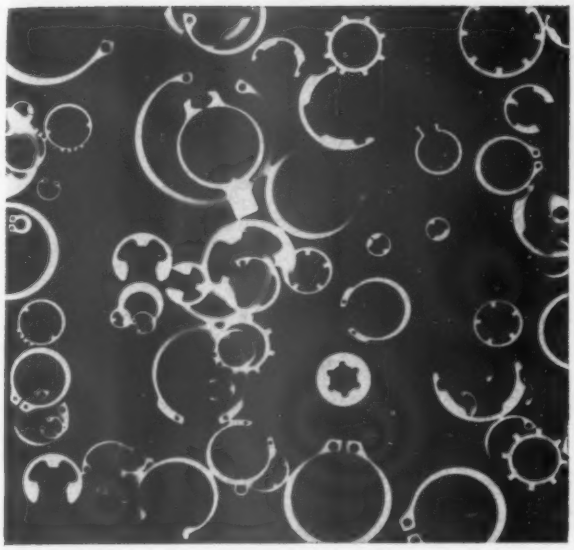

This reverse photo print shows a representative collection of stamped retaining rings.

is used widely in business machines, toys, and electronic assemblies.

A number of simple tools are available to speed the installation or removal of both axially-assembled and radially-assembled rings.

The tools most frequently used for the axial types are retaining ring pliers which grasp the rings securely by the lugs. Pliers for internal type rings are designed to compress the fasteners for insertion into a bore or housing; external pliers expand the rings for assembly over a shaft. For large size rings, ratchet pliers are available which reduce the effort necessary to spread or contract the rings and lock the fasteners at any given point of expansion or compression.

Radially-installed rings may be assembled rapidly with special applicating tools which enable the operator to grasp the ring and install it in the groove in one easy motion. Special dispensers which accommodate stacked rings are used widely in high-volume applications.

It is possible to construct a number of simple assembly fixtures which may be operated manually or in a foot or arbor press. The most widely used are a tapered sleeve and plunger for compressing internal rings and a tapered stud and sleeve for expanding external rings.

Both axial and radial ring types may be installed by mechanized equipment utilizing various forms of stacked or hoppered feeding. While it is difficult to establish an exact level of ring consumption at which mechanized assembly techniques become profitable, there are two criteria which may be used. One is where the total number of rings installed at all assembly stations exceeds 500 per hour and the ring grooves are readily accessible; the other is where the operator must assemble a complicated group of parts or where two or more rings must be installed simultaneously. In both cases, assembly time savings often pay for mechanization costs within a few production runs. •

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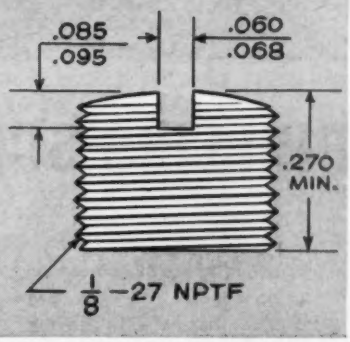

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The "engineered fit" between Phillips driver and recess assures a positive purchase in any driving operation. This permits the maximum amount of torque to be applied, locking the screw to stay. With no danger of driver slippage, there's no cautious "holding back" and lessening of torque on the part of the operator. There's no need to back up screws a quarter turn to line up heads which weakens assembly. And, in wood products, Phillips screws can often be inserted without pilot holes—always a stronger assembly.

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Together, these are the reasons behind today's national acceptance of the Phillips recess. It has been adopted by leading users and is represented in practically every type of assembled product. Its recess is reproduced in every type of head configuration. It has been constantly improved to increase driveability and quality. It is made to a universal standard by most leading fastener producers. Take advantage of these plus features; specify Phillips screws. o.3

SCREW RESEARCH ASSOCIATION

PHILLIPS CROSS-RECESSED-HEAD SCREWS . . . THE FASTENER WITH A PLUS

Autonetics has come up with some assembly concepts which are adaptable to many other types of complex electronic products

COMPUTER ASSEMBLY TECHNIQUES

Here is a Recomp computer in an office setting. Intended specifically for engineering and scientific work, it is meeting with wide acceptance. It is a product of Autonetics, a division of North American Aviation.

by **William D. Engstrand,** West Coast Editor

Computer assembly is a project which demands many specialized techniques to solve the numerous intricate problems involved. As with so many highly complex electronic products, some of these problems vie with the limits of human experience and skill. In such cases, auxiliary assembly techniques must be employed to insure against possible error. More specifically, human memory based on past experience must be replaced by specific instructions and guides relative to the operation involved. Trying to assemble a computer along an uninstructed and unguided assembly line would be like trying to build a space vehicle in a blacksmith shop.

An example of the complexities involved can be found in the relatively small office-type Recomp computer now being produced by the Autonetics Division of North American Aviation Inc., Downey, California. It is a general purpose machine for engineering and scientific use. Some 8347 wires leading to a possible 11,121 pin locations and connecting approximately 20,000 electronic components are assembled neatly into a space 16 inches wide, 3 feet high, and 2 feet long. This does not include the various memory discs, mechanical drives and connects, and plastic and metal panel components which hold and space the assembly as required.

Prior experience with complex electronic assemblies at Autonetics warned manufacturing engineers to prepare in advance for assembly of the new computer. The result of this advance planning is assembly concepts which are exerting considerable impact throughout the computer manufacturing field. This article is written because of the adaptability of the Autonetics assembly techniques in many types of complex electronic assembly work, and in hopes that it will provide some contribution to the art of electronics assembly at large.

These new assembly techniques and concepts extend far above the bench gadget which facilitates a single operation. They start in the sales department where a concrete figure concerning the number of

continued

Part of the assembly problem is providing work at an even keel to fully utilize the skills of high-trained assembly workers.

computers which will be required to fill orders during a specific period of time is obtained. With requirements firmly established, assembly operations can then be planned to best utilize departmental facilities and an unfluctuating (in number) group of experienced computer assembly personnel.

Computers, like many highly complex electronic products, are definitely not a mass production item. But they are just as definitely not a product which can be properly and dependably assembled by people who are "hired and fired" as needs dictate. Therefore a concrete part of the assembly problem is to provide work at an even keel, so that the same group can be steadily employed even though occasional workshift changes are involved.

PLAN ASSEMBLY SEQUENCES BY "BLOCKS"

Assembly planning starts as soon as the number of computers that will be required during a specific period of time is ascertained. The upcoming assembly job is first broken down into components or "blocks". Each block contains a specific portion of the following work. The number of blocks will be based upon the market forecast, increasing with the number of computers required. An effort is made to establish definite maximum skill level requirements in each block of work to facilitate deployment of assembly personnel.

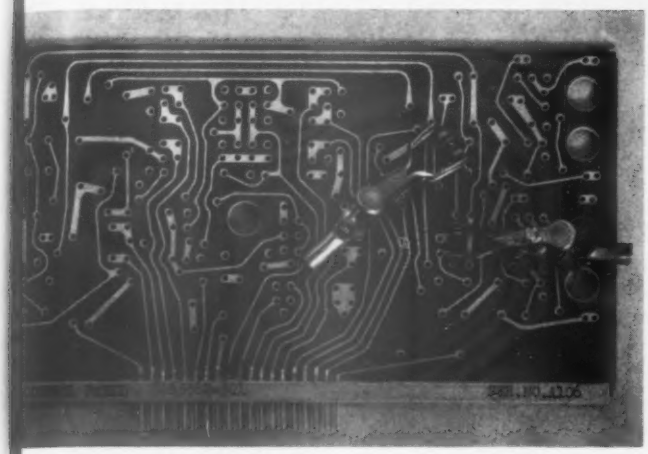
As computer assembly involves the use of many sub-assembly lines feeding into a final assembly line, each work block is planned so that it has a concrete termination. Thus one work block may produce the printed circuit boards, while other blocks will include the installation of the electronic components on these boards. A third work block may involve the installation and wiring of several boards together into a concrete sub-assembly circuit. This progresses until only a relatively few major sub-assemblies must be joined together during final assembly. Component assembly in the manner described greatly simplifies in-progress testing and inspection as the component assemblies may first be checked individually, then in groups as the sub-assembly circuit grows.

After an assembly job has been broken down into blocks and the work blocks laid out on the assembly line, it is time to examine each work block individually and arrange the work within it to the best advantage. The sequence of assembly within the block is planned. Assembly facilities are arranged or installed to expedite the specific assembly operations. In all cases, time and motion studies are made and the results are incorporated in the work block. It is at this stage of planning where helpful assembly gadgets and specific techniques first enter the picture.

As already noted, computers are definitely not a mass production item. Furthermore, because of the rapid advancement in the art and science of computer use and design, design and engineering changes are constantly occurring. This precludes pre-assembly of a large number of computers for stock purposes. In a very short time, such "stocked" machines might become superseded by newer models and their value thus drastically reduced. That is why assembly operations must be based on market forecasts for immediate requirements.

At odds to this situation is the fact that when anyone purchases a computer, he expects delivery within a reasonable limit of time. As assembly is by far the most time-consuming element in computer manufacture, the above conflicting factors load another problem on the assembly department's shoulders—computers cannot be assembled ahead of requirements, yet fast assembly is required once a machine is ordered.

Some idea of the complexity of the assembly problems involved can be gained from this view of the interior of the Autonetics office-type computer which is made in their plant in Downey, California.



Alligator clamps with split prongs are used to hold, space and insulate heat-critical components during soldering.

A "pigtailer" is used for pre-trimming resistor and transistor connecting wires to their proper length.

Here again the breakdown of assembly operations into blocks of work proves its value. To begin an assembly job, and to get the various sub-assembly pipe lines filled with work, all departmental employees may be deployed through two or three workshifts on the various initial sub-assembly work block lines.

As initial sub-assemblies accumulate at the end of these initial lines some of the employees are removed from the initial lines and moved forward to other lines. This progression continues until some of the employees have reached the final assembly line and the workload is balanced throughout the department. This, in effect, is efficient concentration of assembly effort when and where it is needed most.

An objection might be raised at this point due to the personnel problems that might be expected from asking assembly employees to change from one workshift to another then back again. At Autonetics, very little trouble has been experienced from this source. As the planning is always well ahead of actual operations, the employee is informed well in advance when he will be asked to change workshifts temporarily. He is thus prepared for it and usually makes the change willingly.

There is another factor in the new concepts of assembly now in effect at Autonetics which should be mentioned here. This has to do with sub-contracted assembly work. The company's own assembly department could be expanded to encompass all the work being accomplished at this time. But it is the opinion of Autonetics officials that such so-called "hogging" of work would mean losing three direct benefits.

THE ART OF COMPLEX ELECTRONIC ASSEMBLY

First, the art of complex electronic assembly work is still in its infancy. It will benefit industry as a whole to have the level of this art raised as this will increase the dependability, utility, and thereby the usage of complex electronic products. By "farming out" portions of complex computer assembly work, it is felt that a direct contribution is being made to a higher experience level in other plants.

Secondly, and in logical expectation that the use of computers will increase tremendously in the near future, sub-contracting work now is like preparing a man for the job ahead—when sub-contractors are urgently needed, they will be qualified, experienced, and ready to go.

Third, and of more immediate value, when work is sub-contracted, the experience, know-how, and creative ability of the sub-contractor is literally added to that of the company letting the work. Many important inventions have originated in back-yard workshops. Even a very small sub-contractor may come up with assembly innovations, ideas, and techniques which have escaped entirely the attention of engineering or manufacturing personnel in the larger organization. This feedback of original information and ideas from sub-contractors is and will continue to be valuable both to the contracting company and the status of the art as well.

DEVELOP NEW TECHNIQUES AND GADGETS

It would be unfair to end this article without first describing some specific techniques and gadgets developed along the Autonetics computer assembly line. They could be vastly helpful in any type of electronics assembly work.

First is the split-prong alligator clamp. It is used to hold, space, and insulate diodes and transistors while they are being hand-soldered to a printed circuit board. As the computer circuit boards have components installed on both sides, dip-soldering cannot be used. But these simple clamps effectively hold and space the component on the board. At the same time they provide a heat shunt for the heat-critical component being soldered in place.

Secondly, after considerable experimentation, a universal soldering tip was developed which can be used without change on all sections of the assembly line. This saves the time required to change tips between jobs. Auxiliary tips are provided for rework and other jobs not directly on the assembly line.

continued

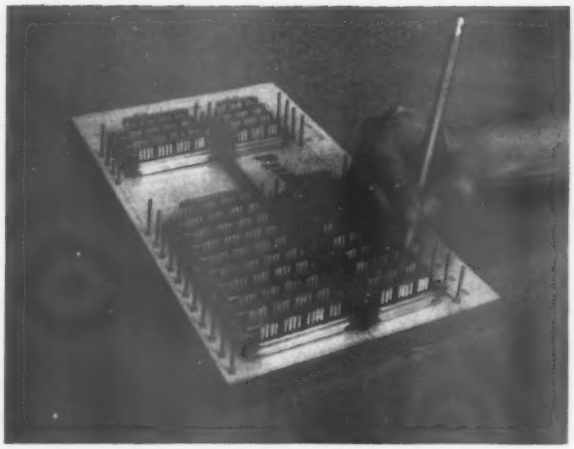
Because of the numerous pin connections in a computer circuit, it was found expedient to color-code the pins much like resistors are color coded to indicate their value. But in this case color coding resolves into a number which in turn will be duplicated by a numbered call-out on the wiring diagram. If a panel contains 30 rows of 20 pins each and the wiring diagram calls out a connection to pin row twelve, row twelve is immediately indicated by the color-coding of the pins and the assembly operator does not have to "count off" from one side of the board.

FINGER RACKS HOLD PRE-CUT WIRES

Another innovation is the use of finger racks for wires, with the pre-cut wires placed in the rack in the sequence of their installation. During a sequence of assembly operations, the operator merely follows across the rack, selecting one wire then the next, in the same sequence as they are racked. This "easy" wire supply has proved to be a substantial time saver.

Methods studies prove that it is the small motions which mount up to considerable overall time in electronic assembly work. If a worker has to pick up a pair of cutters to trim the connecting wires on a diode or resistor to the proper length each time he installs one, this simple act will add up to considerable time during an eight-hour shift. Autonetics therefore employs a small automatic "pigtailer" for trimming these leads to length before the components are delivered to an assembly station.

Finally, and extremely important in conjunction with the continual refinement of assembly operations and techniques, Autonetics employs experienced manufacturing engineers who are continually "on the floor" in the assembly department. These men take up where the design engineers leave off.



Pencil points to color coding used to identify various connector pins. Coding makes it unnecessary for assemblers to count rows from the edge of pin board.

ON-THE-SPOT ASSEMBLY ENGINEERING

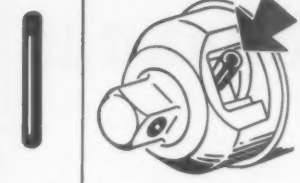
Their job is to observe, experiment, improve, streamline, and automate wherever possible. It would be impossible to accomplish this work from a distant engineering department with only an occasional visit to the assembly line. "On-the-spot assembly engineering" would be the best description of their task.

Such localized effort coupled with the new concepts of electronics assembly now in effect at Autonetics has proved very effective to date. •

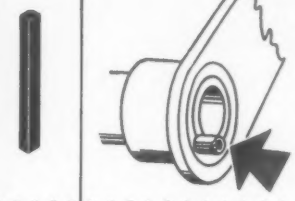
Wiring a memory drum is only one of many complex jobs.

Wires are racked in the sequence of their installation.

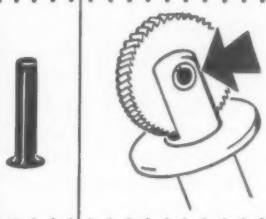
Rollpin® replaces 12 different fasteners



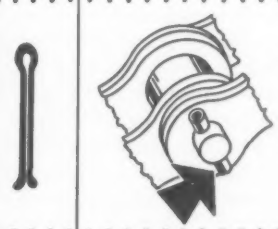
REPLACING A GROOVED PIN . . . in this application, Rollpin serves as a stop pin in a ratchet wrench adaptor. With its light weight and high shear strength, Rollpin functions perfectly . . . cuts assembly costs.



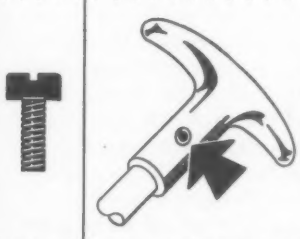
REPLACING A KEY . . . Rollpin demonstrates its ability to do away with precision tolerances, in this heating system damper arm. Faster, cheaper and more satisfactory than previous assemblies.



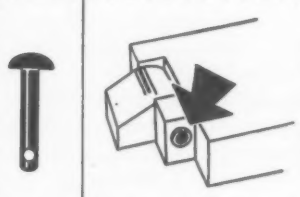
REPLACING A RIVET SHAFT . . . Rollpin serves as an axle for the sparkwheel of a cigarette lighter. No riveting or threading necessary . . . faster assembly. Note flush, clean fit.



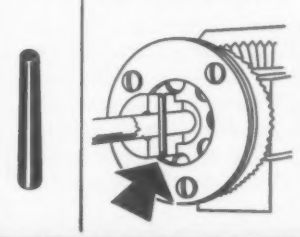
REPLACING A COTTER PIN . . . Rollpin assembly time is shorter, service life ten times longer. Vibration-proof flush fit. Easily removable.



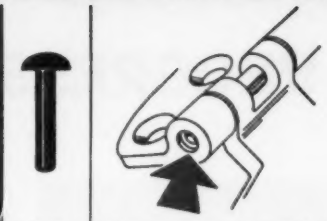
REPLACING A SET SCREW . . . to fasten automobile brake handle a short length Rollpin is self-retained in the hand grip but can easily be driven into over-drilled hole in shaft for simple handle removal.



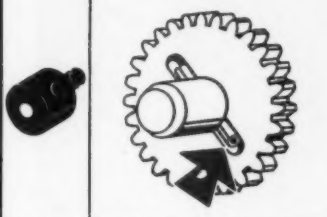
REPLACING A CLEVIS PIN . . . here Rollpin holds firmly in clevis, permits free action of moving member. Rollpin application shown is the plate of a home workshop tool.



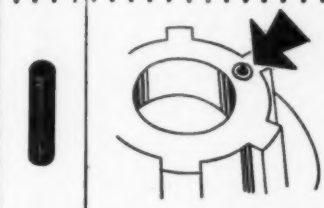
REPLACING TAPER PINS . . . in the assembly of precision differentials eliminated cost of taper pin reamers and the entire reaming operation. Rollpin costs less than a taper pin and installation is cheaper. They remove easily.



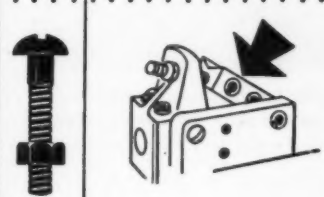
REPLACING A HEADED PIN . . . in this hinge pin application, Rollpin is simply and inexpensively driven in place, greatly reducing assembly costs. Constant spring tension holds Rollpin firmly in place . . . eliminates loosening of hinge due to wear.



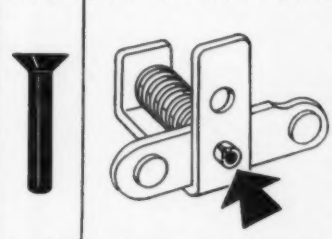
REPLACING A HUB ON A GEAR . . . Rollpin, self-retained in shaft, is simply snapped into molded slot to position sintered gear. This application, by an office equipment manufacturer, effects major savings in assembly. Rollpin's high shear strength is particularly valuable here.



REPLACING A DOWEL PIN . . . Rollpin is used here to prevent rotation of a thrust bearing. No reaming, no special locking. Easily removed. Lowest possible dowel pin cost.



REPLACING A BOLT AND NUT . . . Rollpins act as fasteners and pivots for the linkages in this electric welder. Rollpins may be used with a free fit in outer or inner members depending upon product design requirements.



REPLACING A RIVET . . . Rollpin serves as guide shaft for spring-loaded electrical interlock contacts. This electrical equipment manufacturer reports that rivet failure previously occurred at the clinched end under normal operating impact and vibration.

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PROGRESSIVE LINE CHANGES

Fixture at work-bench height holds sub-assemblies for clamping additional components for progressive welding operations on Temco gas heaters.

Seam on bottom edge of radiation chamber is inaccessible to electrodes on seam welder, so a spot welder is utilized to close the seam. Since the entire unit is finished in Ceramiclad, no seam leakage can occur.

By slightly modifying design, adding a seam welder, and making radical changes in assembly layout, Temco simplified gas heater production

BY **Darrell Ward,** Engineering Editor

Temco, Inc., of Nashville, Tennessee, makes gas heaters among other related items under their own brand labels and as second label suppliers to large distributors of this kind of merchandise. For a plant of this kind, any slight kink in the smooth flow of parts and materials along production lines must be ironed out whenever and wherever they are found. Such a kink-ironing project became a major issue in one section of assembly on combustion chamber units when Temco engineers tackled the problem from more than one direction at once. By introducing a couple of relatively minor modifications in an original design, adding one seam welder, and making radical changes in assembly layout, they were able to gain much needed space for storage and additional operations, eliminate 3 welding operations, and overcome a problem of 10% rejects in final assembly.

Production originally called for 9 spot weld operations and 3 seam weldings because of 19 miscellaneous parts which made up the total combustion chamber sub-assembly. The 20 gage deep draw enamel quality sheet steel in this unit obviously could be welded by different techniques, so this was one of the first problems tackled. It is faster and often easier to seam weld than to spot weld. And it is logical when you must fully close a seam against escaping fumes or gases. However, the shell parts of the chamber were not all feasible for seam welding. Some edges were inaccessible to the electrode rollers of a seam welder.

Instead of letting this become an impossible problem, the part was made accessible by introducing a relief angle of only about 6°—not enough to change radically the basic design, but enough to clear the 7″ electrode rollers which would interfere with other parts in a continuous pass. A jig was made up to roll on a metal platform but still hold the sub-assembly rigid and tilted at the slight angle.

Along with this change came an opportunity for a slight switch in sequence of sub-assembly and, therefore, better utilization of equipment with less handling than the previous shuttling back and

BOOST WELDING EFFICIENCY

forth with other sequences in between. A better comprehension of this improvement can be found in the camparison between old layout and new.

In the old layout, an apparently logical arrangement had been made with spot welders and seam welders in a straight line. And, there was a neat appearance (on blueprint) from the close proximity and alignment of the machines. The problem, however, was that production flow did not allow straight line sequence of parts through the well-organized array of machines. A plant of this kind must cope with model changes, as well as engineering improvements in a given model. It is possible for production flow and even some specific methods to change rapidly because of one expediency or another. Neither methods nor production can be sacrificed to make a machine layout look good on paper. Experienced engineers usually are practical people who can apply empirical methods as well as methods by the book.

The combustion chamber under discussion became the eventual bottleneck that was inevitable with the old layout. Parts could not move from one welder to the next, nor could they move in straight line from one operation to another, with welding done in between. Little floor space was available around the welders in the neat layout, so even if sequences were more appropriately ordered, parts had to be stockpiled somewhere between operations. This required trucking of parts from storage to machine and back to storage before the next machine was employed.

The new layout is essentially straight line with turns, mostly working over roller conveyors, except for lifting and handling at work positions. Parts enter the line at one end, then flow around through sequential operations and finally, back to parts storage. The conveyors also serve as surge equalizers with many storage room problems eliminated.

When comparing the old and new plans, it must be remembered that this is a high production plant which cannot be shut down for a lengthy period for major plant layout changes or for extensive modifications of the product. Such things have to be tackled on the run, as they occur, and by all individuals involved in each change.

While a new machine is being installed, or another being moved, and conveyors are being located somewhere in between, the general flow of routine production must not be seriously interrupted. That is why the changes which were made are more significant than they first appear. Each had to come gradually so it would not disturb the line more than necessary.

continued

These seams were inaccessible to this seam welder until a 6 degree relief angle was introduced as a design modification. Seams are closed at the rate of 100 ipm.

This clamping fixture properly locates leg-mounting bracket in a simplified set-up. Entire unit is held with all parts within the normal 1/32 tolerance permitted, but with previous cumulative errors completely eliminated.

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We often find new plants with ideal layouts which are beautiful examples of well-planned engineering, both in product and in plant layout. But, it is not too often that step-by-step changes can be found in a plant like Temco when even greater ingenuity is demanded and the results can be such an improvement.

Another interesting feature of Temco's combustion chamber assembly is that "horse-and-buggy" methods of gas welding were employed to eliminate rejects, develop greater reliability in the part, and avoid one forming operation in deep drawn parts.

Leg brackets, which tie together the three chamber units, were formerly designed to be spot welded to the seam flanges. This was an obvious way to assemble the parts, but there was a cumulative error in alignment of the three units. The slight errors made in spot welding could sometimes result in a total misalignment of as much as ⅜" on cumulative errors of 1/32", standard tolerance for this kind of sheet metal work.

Redesigning of the leg brackets eliminated an embossing of the parts to locate the brackets, and permitted a more simplified assembly using a clamping fixture to position the brackets and hold all parts in perfect alignment.

With this redesigning of parts and clamping in the fixture, the unit became too heavy to lift for spot welding, but spot welding was impractical anyway. Therefore, the old method of gas welding turned out to be a very modern improvement which completely ruled out the approximate 10% of rejects which were cropping up on final assembly because of misalignment.

When engineers and production people can retain open minds to utilize an old fashioned method to enhance modern production requirements, the company is certainly in position to meet competition of the times. It would be interesting to see such people released of all limitations or inhibiting elements if they were called upon to set up a new plant for a single-purpose function. •

Since new arrangement makes the assembly impractical to reach with spot welder electrodes, gas welding solves problem of locking 19 parts into perfectly aligned unit.

Practical Design Tips

No. 4 of a series

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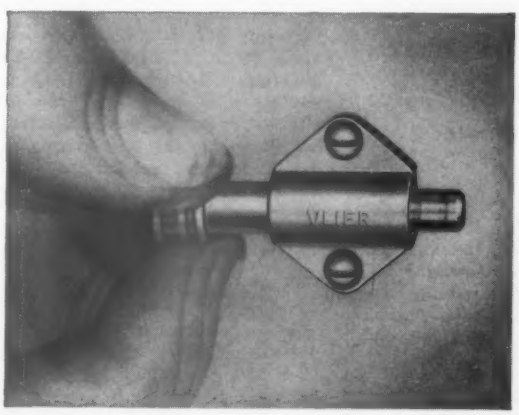

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ARMSTRONG CORK

A telephone line direct to the home plant will allow visitors at Booth 117 to question research men in-the-know. Industrial adhesives, including Eastman 910, gaskets, friction materials, teflon, cast urethane and asbestos products will be displayed and demonstrated.

Use postpaid card. Circle No. 3

BRISTOL

A gun-type pneumatic machine for either portable or stationary use will automatically feed and drive all standard set screws. It features rotating hopper, selector orientation, preset torque. Miniature hex and spline socket flathead and button-head cap screws will be displayed in Booth 1133.

Use postpaid card. Circle No. 4

DZUS FASTENER

For high tensile and shear load applications, the Universal fastener will be featured in Booth 505. It is recommended for electronic and aircraft industries, has a fast four-lead thread and requires 270° rotation to fully lock or unlock. Spiral cam quarter-turn, panel and quick-disconnecting fasteners will be shown.

Use postpaid card. Circle No. 5

EATON (RELIANCE)

Two new fasteners make appearances in Booth 1243: the Tenz-Nut, a standard hex nut preassembled with a spring lock washer (particularly suited for products with finished surfaces) and a self-drilling, self-tapping screw designed for either power tool or automated assembly (see photograph).

Use postpaid card. Circle No. 6

ELASTIC STOP NUT

Prominent in Booth 309, 311 will be the new quarter-turn quick release panel fastener. Using a stop nut as the latch-lock element in the basket retainer, the threaded stud can be tightened to establish tension. A lightweight 550°F double hex nut for 220,000 psi use is the latest in ESNA'S 4000-item fastener line.

Use postpaid card. Circle No. 7

FERGUSON MACHINE

Components and machine bases for high speed assembly in Booth 1143 will include mechanisms indexing up to 2000 times a minute, standard index tables and in-line assembly machine bases and clutch-brake motors designed for rapid start-stop and impulse applied loads.

Use postpaid card. Circle No. 8

GRIES REPRODUCER

Thousands of zinc and plastic parts —the products of fully-automatic single cavity die casting and moulding —will be exhibited in Booth 1524. Supplementing the fastener display will be samples of the many gear and pinion combinations possible.

Use postpaid card. Circle No. 9

Going to miss the Show? Use postpaid card opposite page 58 to have material sent to you.

GROOV-PIN

Locking pins, drive studs and self-tapping inserts will be displayed in Booth 312. Requiring only a straight drilled hole, the vibration-resistant pin is quickly installed. Tap-Lok inserts are designed as a permanent fastener in soft metals.

Use postpaid card. Circle No. 10

HELI-COIL

The automatic wire thread insert assembly machine now in operation on Ford's transmission line will be displayed in Booth 324. Installation tools, hopper feed units and special power tools will be shown, along with all types of Heli-Coil inserts.

Use postpaid card. Circle No. 11

HUCK

Prototype fasteners still in development will highlight Booth 706 display, including hole-sizing Huckbolts which automatically size drilled holes to precise tolerances during installation. Standards include blind rivets, installation tools and related power equipment.

Use postpaid card. Circle No. 12

JOHN HASSALL

"Designing for Cold Heading," is the theme of Booth 1122 which will include enlargements of cold headed parts which have cut production costs. Case history displays, samples of modern cold headed parts and a continuous showing of slides will also be featured.

Use postpaid card. Circle No. 13

MACLEAN-FOGG LOCK NUT

Visitors will be permitted to apply lock nuts on simulated applications in Booth 1043. Two-way lock nuts may be applied automatically without selective devices. The standard line includes flange nuts, open end cap nuts, Uni-Torque lock nuts and projection weld nuts.

Use postpaid card. Circle No. 14

WHEN:
May 25-28

WHERE:
Convention Hall
Philadelphia, Pa.

WHY:
To help plan the products of the '60s

MINNESOTA MINING

Typical joint designs for adhesive bonding, sealers and structural adhesive applications will be shown in Booths 1533, 1535. The new high-strength Scotchweld film adhesive for metal to metal bonding will be demonstrated, as well as composite film and water dispersed contact adhesives.

Use postpaid card. Circle No. 15

PENN ENGINEERING

Two new fasteners augmenting a line of self-clinching captive nuts providing load-bearing threads in thin sheet metal will appear in Booth 93. A captive stud is designed for flush-head press installation in panels from .040" up and a self-clinching fastener features flush mounting on both sides of sheet metal.

Use postpaid card. Circle No. 16

PHEOLL

Cost-cutting applications involving Schweppe studs will be exhibited in Booth 417. Capable of being hopper-fed for automatic assembly, the stud has a milled slot on one end. Sharing the display will be an impact extrusion setup.

Use postpaid card. Circle No. 17

ROSAN

Green glass press terminals that press and lock into sheet metal will be introduced in Booth 1034. With flashover ratings up to 3000 volts and contact ratings up to 10 amp., the terminal's fused glass insulation is unaffected by acids, moisture, alkalis or fungi. Installation is fast, simple.

Use postpaid card. Circle No. 18

SHAKEPROOF

Focal point of Booth 718 will be a hopper-fed belt carrying a wide selection of Shakeproof fasteners, with visitors free to select samples. Three new designs will be shown: a screw combining a finishing washer and phillips oval head, a dished and conical washer and nut unit, and a rivet-head screw.

Use postpaid card. Circle No. 19

SIMMONS FASTENER

Hook-Lock, a new latch for military and commercial containers, is being introduced in Booth 325. Providing a closing pressure of 200 lbs. without use of springs, its carrying load capacity is 750 lbs. The latch extends 7/16" from the container surface.

Use postpaid card. Circle No. 20

STANDARD PRESSED STEEL

More than a dozen fastening advances will be exhibited for the first time in Booth 617. Bolts for 260,000 psi use, for 1600°F use, self-locking coupling nuts, swage nuts, removable and reusable blind-type bolts, featherweight nuts and flush-seating plugs will supplement the standard line.

Use postpaid card. Circle No. 21

STAR EXPANSION INDUSTRIES

Hammer driven blind rivets displayed in Booth 1106 eliminate the need for explosives, special tools or special skills. Aluminum alloy Pin-Grip has a knurled drive pin which, when driven flush with the head, expands and locks. It is especially suitable for blind or limited access applications.

Use postpaid card. Circle No. 22

SYNTRON

Vibratory materials handling equipment will be shown in Booth 1436 as both complete units and components to be engineered into prime equipment requiring agitating, settling, elevating and feeding or conveying motion. Automation equipment includes parts feeders for assembly.

Use postpaid card. Circle No. 23

J. L. THOMSON

Rivet setting demonstrations in Booths 1630, 1632 will illustrate features of the 200 assembly machines available. A rotating belt shows some of the 8000 different rivets manufactured. Electrical contacts, contact materials, assembly machines will be displayed.

Use postpaid card. Circle No. 24

TINNERMAN

How Speed Clips—spring steel fasteners—play a key role in the assembly of a new steptuner for TV channel selection will be featured in Booths 321, 323. Small parts are kept to a minimum in this latest of electronic design in which fasteners serve as actual components.

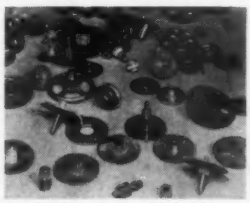
Use postpaid card. Circle No. 25

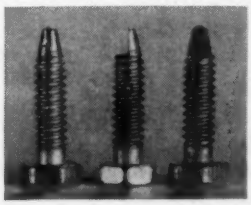
TORRINGTON

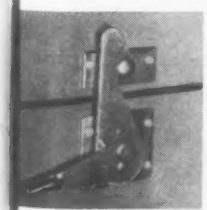
Both the Progressive Mfg. Div. and Specialties Div. will share Booths 1329,

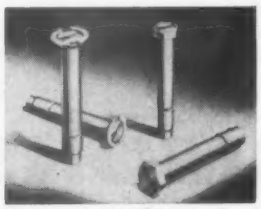
Continued on page 70

These are but a few of the 12,000 products to be exhibited at the fourth annual Design Engineering Show.

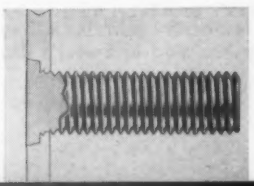


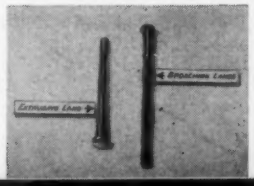


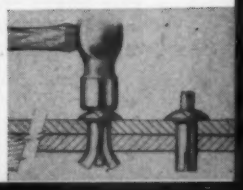




Top row, left to right: Gries' single-cavity die cast gears are available in 195 varieties; Self-drilling, self-tapping screws are new at Eaton's Reliance division; Loctite sealant is being packaged in experimental kit for design engineers; Middle row: Hook-Lock latch by Simmons provides 200 lb. closing pressure for containers; SPS Sleev-Lock is a new removable, reusable blind fastener; Bottom row: Self-clinching captive stud by Penn Engineering is designed for flush-head installation; A 12-station table is typical of Ferguson assembly machines; Huck is developing automatic hole-sizing bolts; Star expansion blind rivets are hammer driven.







Note—Commercial and Military Packaging Engineers:

LINK-LOCK

...Is the rugged answer to your exacting container closure problems

LINK-LOCK plays an important role in the design of this container

Simmons' LINK-LOCK provides pressure-tight, impact-resistant closure, plus quick closing and opening, on this reinforced fibrous plastic product made by the new automatic pre-form process developed by Pressurform Container Corp. The two-section container will be used by the Light Military Electronic Equipment Dept. of General Electric Company for shipping airborne radar jamming units to the Air Force.

Of prime importance are the container's lightness, strength, rust- and mildew-resistance, ability to withstand high pressures without distortion, ease of locking and opening, and low cost.

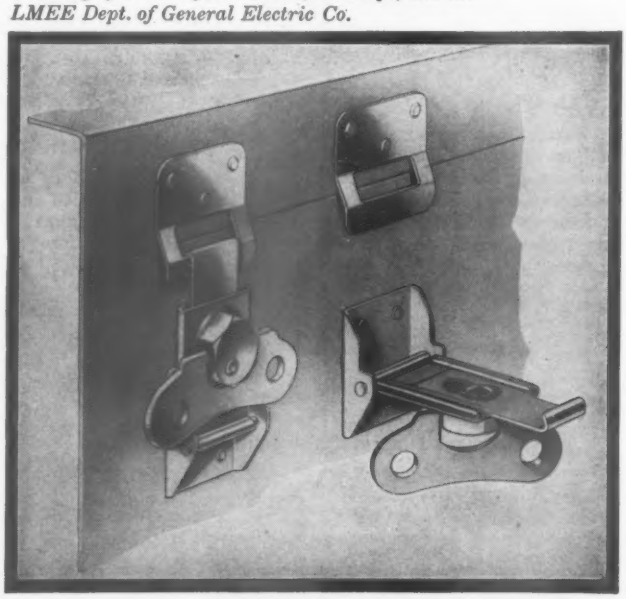
Here's why LINK-LOCK is ideal for use on military cases produced to exacting specifications as well as on inexpensive commercial containers:

- High closing pressure with light operating torque... insures pressure-tight seals where required.
- Impact and shock resistant (positive-locking).
- Compact design... lays flat against case even when unlocked.
- Available in 3 sizes, for heavy, medium, and light duty.
- Opening and closing by wing-nut, screwhead, or hex nut.
- Flexible engagement latch design,..can be varied to suit different conditions.

Also available! Spring-Loaded LINK-LOCK... ideal for less expensive containers where costs won't permit precision production. Spring provides take-up to compensate for set in gasketing, irregularities of sealing surfaces, and mounting inaccuracies.

Where does the versatile Simmons LINK-LOCK belong in your design? For full information and specifications, send for LINK-LOCK DATA SHEETS today. Samples and engineering service available upon request.

Courtesy of Pressurform Container Corp., and the LMEE Dept. of General Electric Co.



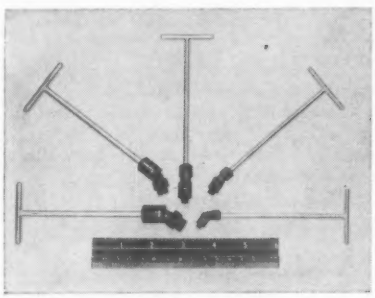
Visit us at Booth 325, 1959 DESIGN ENGINEERING SHOW
Philadelphia, May 25-28

SIMMONS
FASTENER CORPORATION
1796 North Broadway, Albany 1, New York
QUICK-LOCK SPRING-LOCK ROTO-LOCK LINK-LOCK DUAL-LOCK
See our 8 page catalog in Sweet's Product Design File.

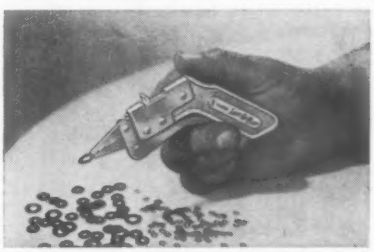
Use postpaid card. Circle No. 226

WHAT'S NEW IN EQUIPMENT

For information on any equipment listed here, use the postpaid card opposite page 58. Just circle the number on the card matching the number following the description. We'll do the rest.



(See 35)



(See 38)

(See 36)

CAP SCREW WRENCHES OPERATE IN TIGHT SPOTS

A socket head cap screw wrench line is designed to reach places normally inaccessible by standard type Allen wrenches. It permits a full turn without resetting the wrench in the cap screw head.

Available in five sizes, the wrench yokes are milled from solid steel blanks and are small enough to enter the counterbore of the size cap screw it is applied to. The handle is integral with the universal, eliminating the possibility of slipping. Length of the wrench is 5¼".

Abington Machine Co., 8824 Alpine Rd., Detroit 4, Mich.

Use postpaid card. Circle No. 35

AUTOMATIC MACHINE FEEDS, SOLDERS MINIATURE WIRE

Automatic feeding, cutting and shaping micro-miniature wire is done by a machine which feeds the wire from a spool into a tiny hole and solders it. The machine then precision cuts the wire and forms it into an "S" shape.

The machine has been production tested for automatically soldering cat whisker wires into the prong of ceramic crystal diodes. The principle of the machine may be applied to similar operations involving similar shapes or parts.

Designed for manual loading of the prong, the Model 3042 can produce at the rate of 800 per hour, about four times faster than any other available machines. An automatic loading device has been designed.

Kahle Engineering Co., Union City, New Jersey.

Use postpaid card. Circle No. 36

ALL-PURPOSE BRAZING ALLOY MELTS AT 1300°F

A copper phosphorous alloy, which does not require flux on copper to copper joints, starts to melt at 1300° F and has a wide brazing range.

This general purpose alloy finds excellent use on copper, brass, bronze and other alloys. It conforms to AWS specification BCuP-2 and Federal specification QQB-00655a. Phos Sil O has a tensile strength of 90,000 psi.

American Brazing Alloys Co., P.O. Box 11, Pelham, New York.

Use postpaid card. Circle No. 37

PLIERS' VISE LIKE GRIP AIDS SMALL PARTS PLACING

Greater control in assembly jobs involving small-sized units is reportedly achieved with a hand tool designed for grasping and positioning small objects.

The 5" long Lock-GriPlier features a locking arrangement that permits its jaws to achieve a firm grip on small washers, brads, screws, wires and other parts. The new tool can be used as a vise while performing operations like soldering where both hands must be kept free. When used as a vise for soldering, the tool acts as an excellent heat sink.

Maximum control is provided by the trigger and locking key which can be operated by one hand. Forward movement of the key locks the plier's jaws, giving the operator the use of both hands. The case-hardened steel jaws of the tool are specially notched for cutting wire and stripping insulation.

Handicraft Tools, Inc., Division of X-acto, Inc., 48-41 Van Dam Street, Long Island City 1, N.Y.

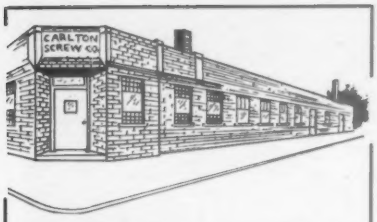
Use postpaid card. Circle No. 38

NON-CORROSIVE FLUX FOR ELECTRONIC EQUIPMENT

A hydrazine flux that leaves no rosin residue, is non-corrosive, non-hygroscopic and permits prefluxing, is designed for use in soldering electrical and electronic equipment.

The non-acid flux vaporizes completely in the heat of soldering; no washing is necessary where all fluxed parts are heated to soldering temperature. There is no danger of fungus attack and joints will not corrode. Prefluxed copper-base parts can be stored overnight.

The following metal surfaces can be soft-soldered with hydrazine flux: copper, brass, hot tin dipped, hot solder dipped, tin plate, solder plate, copper



SOCKET SET SCREWS

Manufactured in strict conformance to physical and dimensional specifications as per ASA B18.3

CURRENT INVENTORY

(Cup point except as noted)
(Out of stock items fabricated in 10 days)

4—40 x 1/8	26M
4—40 x 3/16	16M
4—40 x 3/16 Flat pt.	10M
4—40 x 1/4	40M
4—40 x 5/16	15M
6—32 x 3/32 Oval pt.	2M
6—32 x 1/8	100M
6—32 x 3/16	70M
6—32 x 1/4	150M
6—32 x 1/4 Fluted Cone	35M
6—32 x 5/16	25M
6—32 x 3/8	10M
6—32 x 7/16	15M
6—32 x 1/2	18M
6—40 x 1/8 Fluted Cup	32M
8—32 x 1/8	130M
8—32 x 3/16	70M
8—32 x 1/4	45M
8—32 x 5/16	18M
8—32 x 3/8	22M
8—32 x 7/16	3M
10—24 x 1/4	9M
10—32 x 3/16	29M
10—32 x 1/4	15M
10—32 x 5/16	12M
10—32 x 3/8	25M
10—32 x 1/2	10M
10—32 x 3/4	4M
1/4—20 x 1/4	10M
1/4—20 x 5/16	5M
1/4—20 x 3/8	6M
1/4—20 x 1/2	68M
1/4—20 x 9/16 Flat pt.	39M
1/4—28 x 1/4 Nylon Insert Knurled Cup pt.	40M
5/16—18 x 3/8	18M
5/16—18 x 1/2	10M
5/16—24 x 7/16	105M
3/8—16 x 1/2	19M
3/8—16 x 3/4	8M

Quantities under 1,000 pcs. not listed but available

SCREWS — BOLTS — NUTS — WASHERS — RIVETS

Government and Commercial specifications in all materials and platings

Phone UPtown 8-7330
TWX CG 2676

CARLTON SCREW CO.
2134 W. Lawrence Ave.
Chicago 25, Ill.

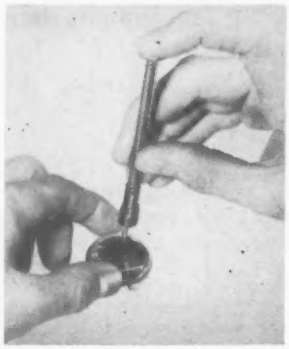
Use postpaid card. Circle No. 227

plate, cadmium plate, zinc, silver plate, beryllium copper and nickel plated brass. It can be used with the following system: common solders of tin-lead; tin-lead-silver; tin-antimony; tin-silver; certain fusible alloys containing tin, lead, cadmium, bismuth, antimony, indium; pure tin; pure lead for bonding to copper.

Fairmount Chemical Co., Inc., 136 Liberty St., N.Y. 6, N.Y.

Use postpaid card. Circle No. 39

SCREWDRIVER TORQUES IN TENTHS OF INCH OUNCES



A precision torque screwdriver for delicate assembly work enables anyone to tighten tiny screws without buckling delicate movement plates, shearing threads or cramping pin gears.

The Tiny Torque screwdriver measures from 0 to 3 tenths of an inch-ounce torque, or can be made to read from 0 to 6, 8 or 10 tenths of an inch-ounce torque. It is designed for No. 0 to No. 2-56 screws, but can be made to fit screw sizes ranging from No. 0 to No. 4 by changing the blade.

The tool measures 4¾" long, including its steel driving tip. It has a polished fingertip rest and easy-to-read white graduations etched on the blackened barrel. A mechanical stop prevents damage from over-torquing. The barrel is knurled for easy handling. The screwdriver is calibrated by gram weights.

Apco Mossberg Co., 1001 Lamb St., Attleboro, Mass.

Use postpaid card. Circle No. 40

NEW CLAD LAMINATE FINISH EASES CIRCUITRY SOLDERING

A new copper finish that assures uniform coverage by all types of acid resistant inks without further surface preparation has been developed for all copper-clad laminated plastics.

Altori finish also permits good solder buildup and coverage, making soldering easier and soldered connections more secure.

The improved printability and solderability of clad laminates with the new finish results in fewer rejects in the production of printed circuits and more reliable performance when assembled in radios, television sets, computers and other electronic equipment.

Taylor Fibre Co., Norristown, Pa.

Use postpaid card. Circle No. 41

FREE FLOWING ADHESIVE CURES AT ROOM TEMP.

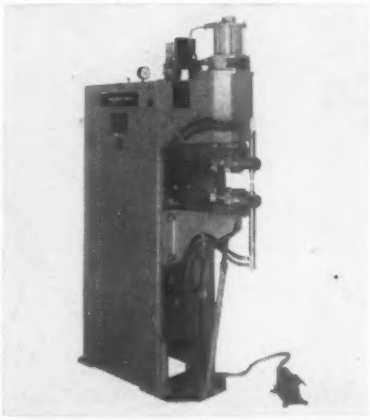
Bondmaster M648T is a high-strength, room-temperature-curing, two-component formulated epoxy designed for bonding all metals and other rigid materials such as glass, ceramics, plastics, plastic foams, and structural laminates.

Fully cured bonds are reported to exhibit minimal shrinkage, are electrical insulators, and are said to provide excellent resistance to weather, galvanic action, and most chemicals, acids, and alkalies.

Rubber & Asbestos Corp., Dept. P, 225 Belleville Ave., Bloomfield, N.J.

Use postpaid card. Circle No. 42

PRESS TYPE RESISTANCE WELDERS 30 TO 500 KVA



Standard press type resistance welders are available in four sizes ranging from 30 to 500 kva inclusive. Each size is available as a spot welder, a projection welder or a combination spot and projection welder in a range of standard throat depths, electrode forces and transformer sizes.

New design features include: one-piece slim line frame, less floor space required, anti-friction slide, adjustable for wear or take up. An integral transformer and lower arm give higher performance and maximum efficiency.

The Federal Machine and Welder Co., Warren, Ohio.

Use postpaid card. Circle No. 43

TOOL ATTACHMENT BOOSTS TORQUING CAPACITY

Nut running is among the uses of a tool which when attached to a ¼" drill provides five times the normal torque of the drill.

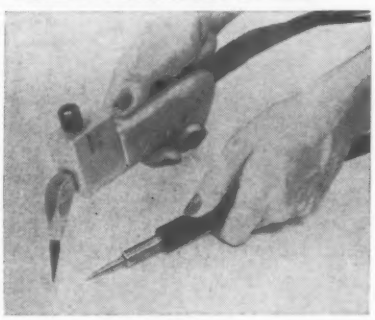
Torc Booster performs tapping, power reaming, honing and masonry drilling.

The user grips the tool body to begin operation, releases the tool to stop action. Hand control is maintained over jamming and chatter.

Grip-Torc Tools, 17480 Shelburne Way, Los Gatos, California.

Use postpaid card. Circle No. 44

PRESSURE PROBE WELDS THERMOCOUPLES



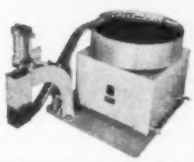
A pressure-sensitive resistance welding probe designed for welding thermocouples consists of a welding lead, complete with pressure-sensing mechanism, and a separate ground lead. The probe fires at a preset pressure from 1 to 25 lbs., producing a heavy current for millisecond durations. Exact repeatability is reported, assuring reliable welds regardless of operator skill or difficulty of location of the weld.

The HP-3030 also may be used to weld honeycomb sections and special electrical and electronic assemblies. The handpiece is useful when only one side of the workpiece is accessible, or where it is impractical to bring materials together for a standard welding head. The separate grounding probe enables completion of the electrical circuit entirely from the top.

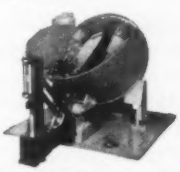
The handpiece may be plugged into any power supply or welder and has a maximum power capacity of 500 watt-seconds.

Weldmatic, 380 North Halstead Ave., Pasadena, Calif.

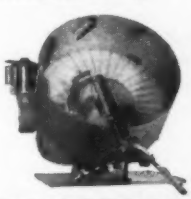
Use postpaid card. Circle No. 45



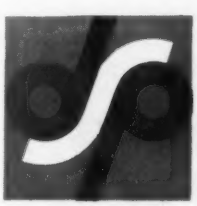
VIBRATORY FEEDER for light, fragile or highly finished parts.



ROTARY FEEDER for high production feeding.



ROTARY HIGH SHELL FEEDER for maximum holding capacity.



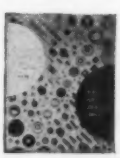
Shuffle and deal parts for automatic assembly with

DPS selective feeders

It takes fast, automatic feeding to satisfy the appetites of today's automatic assembly machines. And nowhere can you duplicate the range of equipment, the specialized experience in selective feeders offered by Detroit Power Screwdriver Company.

The most complete line in industry, DPS parts feeders include rotary, vibratory and elevator types. They handle any product from the tiniest of screws to assembly components the size of your fist . . . range in holding area from eighty cubic inches to 20 cubic feet.

DPS will welcome an invitation to analyze your assembly operations. If lagging production can be traced to inefficient feeding, the problem is as good as answered. Write for catalog on selective feeders.



DETROIT POWER SCREWDRIVER COMPANY

15,038

2815 W. Fort St. • Detroit 16, Michigan

A Subsidiary of Link-Belt Company

Use postpaid card. Circle No. 228

Here's the Bendix-approved method of holding the 951-S Electronic Gripper Cutter plier for maximum efficiency on a high-production assembly line.

Snap-on DESIGNS NEW SPECIAL PLIERS

Bendix BOOSTS PRODUCTION 18 PERCENT ON WIRING OPERATIONS

Bendix Radio, a leader in the electronic field, uses an employe training program. Here workers are shown proper use of the new *Snap-on* pliers.

BENDIX Radio Division needed a smaller pliers for work on small electronic components in close quarters.

Snap-on sales engineer, Carl P. Flanagan, checked assembly line operations, then called in a *Snap-on* design engineer. This tool expert carefully watched the assembly of electronic parts, noting particularly the movements made with the pliers. He then designed a spring-loaded combination needle-nose plier and cutter. This tool in many instances replaced a needle-nosed plier and a diagonal cutter. The new pliers:

1. **Have increased production 18 percent on many wiring operations, through fatigue-cutting design, plus elimination of time wasted in handling two tools.**
2. **Reduced tool cost.**
3. **Have improved quality of production.**

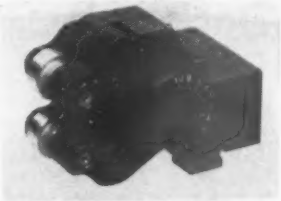
Tool Problems a Welcome Challenge

Snap-on has provided hand tools for everything from checking tension of orthopedic braces to servicing steel mill equipment. We invite the opportunity to place our specialized knowledge at your disposal. Branch offices in 54 key industrial centers throughout the U.S. and Canada.

SNAP-ON TOOLS
CORPORATION
8033-E 28th Avenue • Kenosha, Wisconsin

Use postpaid card. Circle No. 229

THREAD ROLLER AFFIXES TO BROWN & SHARPE MACHINES



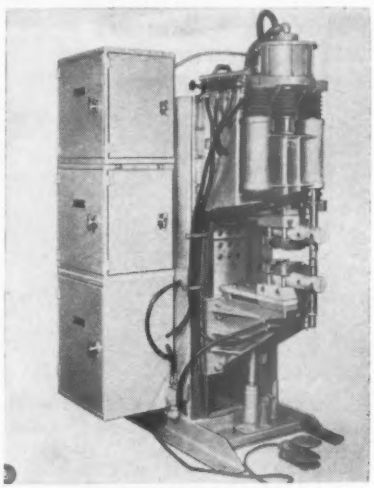
A small size thread rolling attachment for use on the No. 00 Brown & Sharpe single spindle automatic has a diameter capacity from 0 to 5/16" and a maximum thread length of ½".

The model B5 is designed to produce precision threads, is adjustable and self-compensating. The free floating movement of the head in the cross-slide adapter proves parallel alignment of the thread rolls with the center line of the work throughout the entire rolling cycle.

Reed Rolled Thread Die Co., 791 Main St., Holden, Mass.

Use postpaid card. Circle No. 46

SINGLE PHASE, HIGH SPEED RESISTANCE WELDER LINE



Lineal ball bearing sleeves are standard on a new line of single phase resistance welders.

Advantages claimed for the sleeve include friction-free operation of the welding head, pressure resistance, non-binding, non-inhibited ram performance, instant follow-up in controlling weld properties and elimination of need for ram replacement or regrinding.

The sleeve makes practical the use of light metal rams, minimizing inertia.

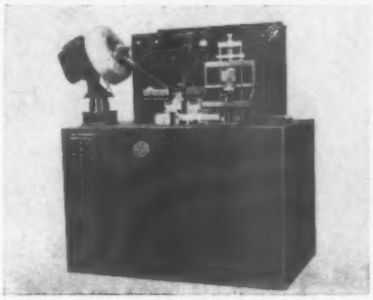
Models can be modified readily and with added controls are reportedly able to duplicate the performance of three phase welders.

Press type spot and projection welders, butt welders, press bench welders and rocker arm spot welders ranging from 5 to 250 kva are being introduced.

Electro-Weld Div., Electric Arc, Inc., 152-1 Jelliff Ave., Newark 8, N.J.

Use postpaid card. Circle No. 47

HARDNESS TESTER CHECKS 2500 PARTS PER HOUR



Up to 2500 parts per hour are automatically checked for hardness by a machine using an electronic gaging system.

The machine features high speed, laboratory accuracy, simplicity of adjustment and can handle a variety of part sizes.

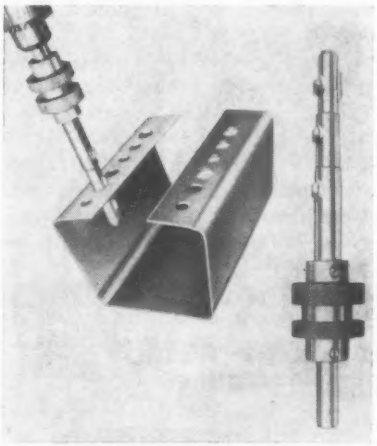
Parts are oriented and positioned on a conveyor which carries them to a checking station, transferred one at a time to the hardness-checking penetrator. After processing, the parts are automatically classified and segregated into predetermined gathering points.

Signal lights on a control panel give a continuous presentation of the operation.

Radio Corporation of America, Industrial & Automation Div., 12605 Arnold Ave., Detroit 39, Mich.

Use postpaid card. Circle No. 48

TOOL DEBURRS THREE DIFFERENT HOLE SIZES



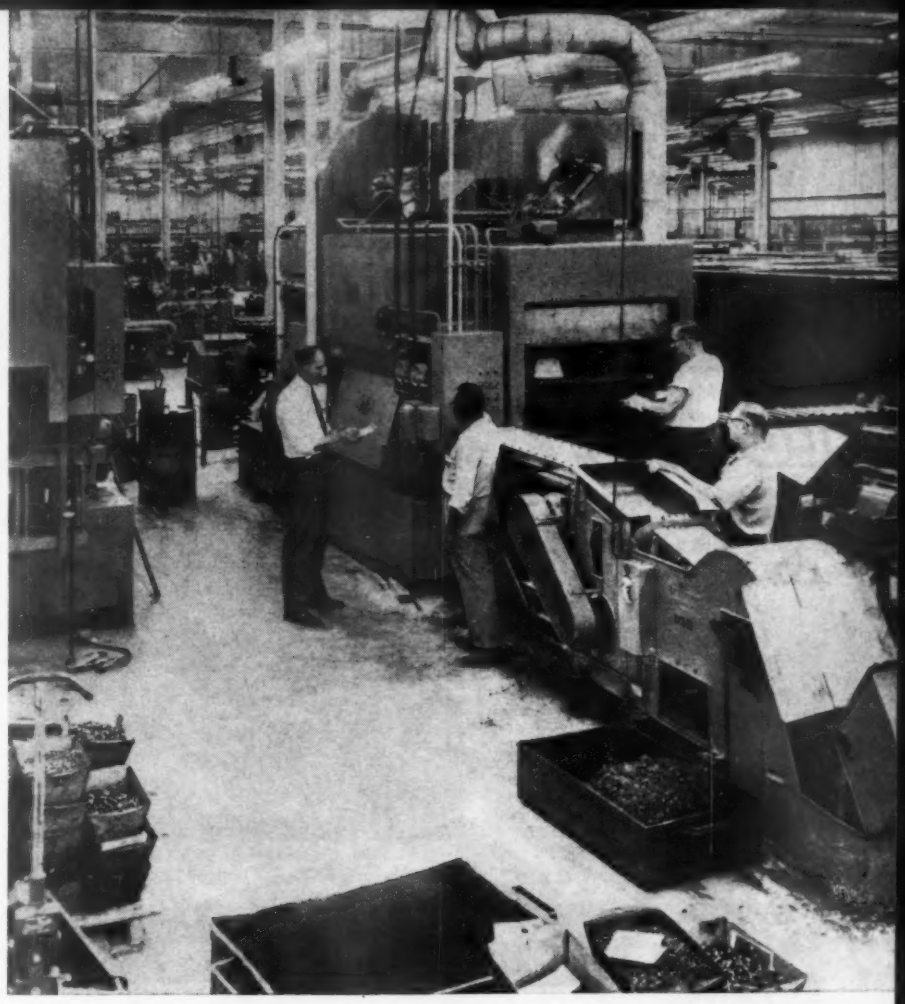
A tool can deburr three different hole sizes without separate tool changes.

Three separate pilot diameters and a cutter blade with three correspondingly positioned cutting heads speed the finishing of holes where one or more surfaces are inaccessible. Used in a portable drill-motor, the tool, as a safety feature, passes through the working hole with cutter retracted.

Three models are available, each accommodating three hole sizes.

Nobur Mfg. Co., 6860 Farmdale Ave., North Hollywood, Calif.

Use postpaid card. Circle No. 49

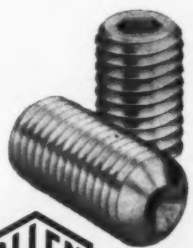


Better Cleaning means Better Socket Screws for You

from ALLEN

These new industrial washing machines wash every Allen product — after each processing operation, and before heat treating — to remove all abrasives and contaminants. After washing, a vibrating de-chipper (shown in the foreground) removes metal particles that may adhere to products in process.

These are among the great many special features in Allen's new plant that assure you of constantly higher quality in socket screws. More than ever, you'll find that ALLEN is the "Buy-Word" for socket screws, as well as keys, dowel pins, and pipe plugs.



The scientific design of the cup diameter on ALLENPOINT Set Screws gives greatly increased resistance to *withdrawal* torque. You can count on Allenpoints to stay tighter longer, under heavy strain and vibrations. This dependable performance is yours to use at no premium in cost. Available in a full range of standard sizes from No. 0 thru 1". For samples and more information, ask your Industrial Distributor, or write direct to The Allen Manufacturing Company, Hartford 1, Connecticut.

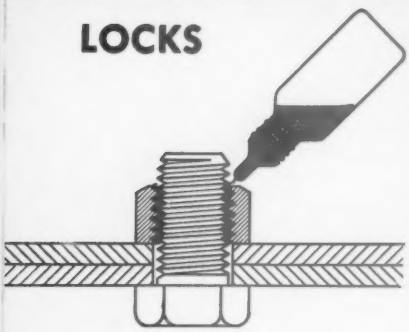
ALLEN HEX-SOCKET SCREWS HEAD

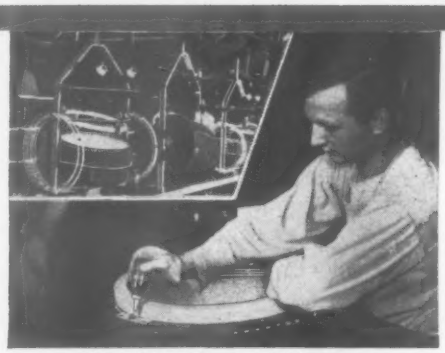
LIQUID LOCK FOR METAL PARTS CUTS COSTS IN PRODUCTION, MAINTENANCE AND SERVICE !

Loctite is a thin liquid that hardens between closely fitting metal parts. It forms a tough heat and oil-resistant bond that secures threaded parts; retains bearings, sleeves; seals pipe and tubing joints. Parts treated with Loctite may be stored for days . . . lock only when assembled.

LOCTITE® provides new methods which simplify assembl

LOCKS





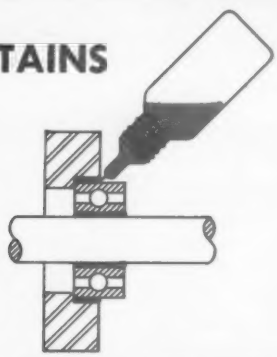
Locking tightened nuts with Loctite on the production line General Electric Filter Flo Washers

LOCKS NUTS TO BOLTS

Locks and Seals Set Screws, Machine Screws, Studs, Adjustment Screws

- One drop replaces lock nuts, lock washers, lock screws, staking, jam nuts, and interference threads
- Makes any threaded part *self-locking*
- Cuts breakdowns and service calls due to loosening of fasteners
- Highest resistance to shock and vibration
- 4 strengths provide any required locking torque

RETAINS



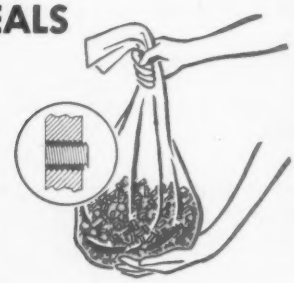
Replacing 9" bearings in jaws of rock crusher, using clearance fit and Loctite. Acme Road Machinery Co., Inc.

HOLDS BEARINGS, OIL SEALS, AND BUSHINGS WITHOUT PRESS FITS

Secures Rotors and Hardened Sleeves to Shafts

- Allows easier tolerances—cuts rejects, rework. Improves alignment.
- Speeds production — parts slip together by hand, lock *after* assembly.
- Eliminates bearing distortion, cracked races, split housings.
- Simplifies field replacement — eliminates reboring, sleeves, shims, weld metal builds.

SEALS



Pipe plugs tumbled with Loctite seal JP-4 fuel at 800 psi in jet fuel control. Hamilton Standard—Div. United Aircraft

SEALS JOINTS AGAINST HIGH PRESSURE FLUIDS

- *Completely* fills joints with tough plastic. No solvents to evaporate, no voids.
- Resists heat, cold, fuels, oil, water, solvents, most chemicals.
- No cleanup problems. Spillage outside joints stays liquid — washes off.
- No pot life problems — easy to automate.

Get the cost-saving LOCTITE story and application engineering service from our technical field men. Write for literature, free sample, name of nearest representative.

LOCTITE® SEALANT

AMERICAN SEALANTS CO., 135 WOODBINE ST., HARTFORD 6, CONN.

WHAT'S NEW IN FASTENERS

For further information on any of the fasteners listed here, use the handy postpaid card opposite page 58.

(See 51)

HEX NUT PREASSEMBLED WITH SPRING LOCK WASHER

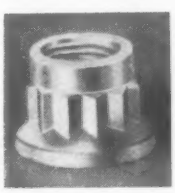
A standard hex nut preassembled with a spring lock washer utilizes the locking principle of the Belleville-type, or cupped, spring washer. The Tenz-Nut has been modified slightly so that it can be assembled on the nut at the factory.

In addition to providing reactive spring pressure to help compensate for looseness which may develop in a bolted assembly, the nut applies "choking" action on the bolt threads as it is tightened in position.

The fasteners will not mar finished surfaces when tightened.

Reliance Div., Eaton Mfg. Co., Massillon, Ohio.

Use postpaid card. Circle No. 50



(See 52)

(See 50)

VIBRATION-RESISTANT, HIGH-TEMP. LOCKNUT

A seating type all metal, free running self energized reusable lock nut will withstand up to 1600°F without thread seizure.

A grooved washer at the bottom of the nut is pressed over the threaded section suspended from the main body of the nut. After torque has been applied, the washer compresses to cause the threaded section to move in and lock radially and axially on the bolt.

Klincher Locknut Corp., 2153 Hillside Ave., Indianapolis, Ind.

Use postpaid card. Circle No. 51

(See 54)

LIGHTWEIGHT LOCKNUT FOR USE AT 900°F

A lightweight, high-strength self-locking nut for use at temperatures up to 900°F has a tensile strength of 200,000 psi at room temperature and 150,000 psi at 900°F.

Designed for use with high-strength aircraft engine bolts having 0.003" reduced pitch diameter, the FN 920 locknuts, forged from aircraft quality AMS 6304 alloy steel, are available with either silver or diffused nickel-cadmium high-temperature plating for corrosion and oxidation resistance. Both finishes can be supplied either with or without Everlube 810 dry film lubricant. The nuts are made in diameter sizes No. 10 through 3/8 inch.

Threads are Class 3B fit and meet military specification MIL-S-7742. The 12-point external wrenching drive permits tightening to induce the high loads needed to maintain fatigue resistance.

Standard Pressed Steel Co., Jenkintown, Pennsylvania.

Use postpaid card. Circle No. 52

FUNNEL FLANGE COPPER EYELETS FOR PW BOARDS

Better solder connections in electronic components and PW boards are said to be provided by funnel flange and flared setting eyelets. Flux trapping is eliminated so that solder flows smoothly around the setting.

The two eyelets are made from electrolytic copper with a co-efficient of expansion closer to etched or printed circuit.

Ease of insertion is ensured by barrel OD of .058" for boards with .062" holes; barrel length is designed for 1/16" thick PW boards.

United Shoe Machinery Corp., 140 Federal St., Boston, Mass.

Use postpaid card. Circle No. 53

BEARING BOLT DESIGNED FOR SLIP RESISTANCE

A high-strength bearing bolt is said to feature slip resistance.

Developed and produced by Lamson and Sessions, the bolt bears knurls about the shank to produce a body-bound fit in steel assembly work. It can be driven easily because of three design features: the frontal shape of each knurl is a section of a small ball; the back face is relieved somewhat like a drill or tap, which prevents packing of displaced metal to insure firm seating; and knurls are spiraled about the shank, based on the principle that turning reduces driving load.

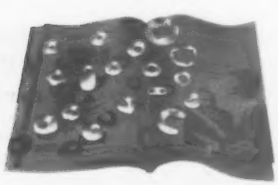
The body-bound fit is achieved when the knurls engrave the joined steel with round-bottom grooves producing a cold-working effect in the holes. Any notching effect of the grooves is thus offset. The bolt head is flat on top to permit driving with an impact tool,

SPECIAL WASHERS ☐ U.S. STANDARD WASHERS ☐ FENDER WASHERS ☐
RIVETING (BURR) WASHERS ☐ LIGHT STEEL WASHERS ☐ FLAT WASHERS FOR
PRE-ASSEMBLY (SEMS) ☐ S.A.E. WASHERS ☐ MACHINE SCREW WASHERS ☐
ALUMINUM, BRASS AND COPPER WASHERS ☐ BELLEVILLE TYPE WASHERS ☐
MALLEABLE BEVEL WASHERS ☐ MINE ROOF WASHERS ☐
MALLEABLE ROUND WASHERS ☐ EXPANSION PLUGS ☐
SPRING LOCK WASHERS ☐ HI-TENSILE STRUCTURAL WASHERS ☐
SQUARE WASHERS ☐ CASTER SHIMS ☐ AN 960 FLAT WASHERS ☐
MACHINERY BUSHINGS ☐

check your washer needs,
JOLIET*
can supply them all!
*QUALITY WASHERS SINCE 1914

Joliet Wrought Washer Company offers the reserve capacity and flexibility needed to meet both your regular and emergency requirements for washers of all types — standard and special. Capacities range from ¼" to 8" O.D. with thicknesses from .008" to ½". In all metals, all finishes, including heat-treating.

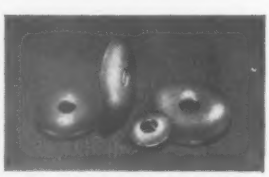
SPECIAL WASHERS



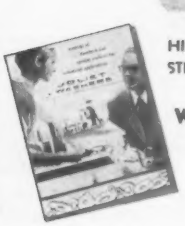
We maintain our own tool and die shop assuring you the utmost in prompt service on new tooling. Your orders are never too large for adequate service, nor too small for personal attention.

Available in steel, stainless, copper, brass, lead, aluminum, bronze. In these finishes: Hardened washers ASTM Specifications, case hardening, carbo-nitriding, dry cyanide cadmium, chromium, copper, zinc di-chromate, phosphate finishes, Parkerizing, hot zinc galvanizing, shot peening, roto-blasting, tempering and electro-plating.

HIGH-TENSILE STRUCTURAL WASHERS



BELLEVILLE TYPE WASHERS



Write for free 16 page catalog

JOLIET WROUGHT WASHER COMPANY
310 Connell Avenue — Joliet, Illinois

Use postpaid card. Circle No. 232

while the remainder is shaped like a rivet head to permit hammer driving. The bolt also can be pulled into place with a standard nut at torques well below final assembly torque.

U. S. Steel Supply Division, 208 S. LaSalle St., Chicago 90, Ill.

Use postpaid card. Circle No. 54

220,000 PSI LOCKNUTS FOR HIGH TENSILE BOLTING

A series of high strength, double-hex, external wrenching, self-locking nuts is offered for advanced design high tensile bolting requirements. Design refinements embodied in the new fasteners develop the full fatigue strength of 220,000 psi bolts.

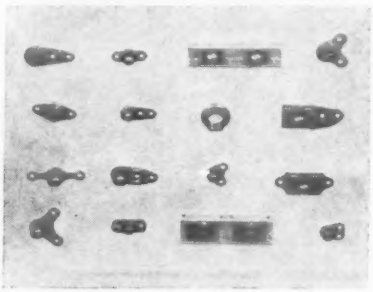
Type LH3393 nuts are claimed to be from 10% to 33% lighter, size for size, than even the lightest 180,000 psi locknut. Further weight saving is made possible by the smaller envelope dimensions of the new parts since reductions of the wrench clearance requirements permit reductions in the size of other structural components.

The nuts are cold formed from alloy steel and cadmium plated with a supplementary molybdenum disulphide dry film lubricant. They are available in thread sizes 1/4-28, 5/16-24, 3/8-24, 7/16-20 and 1/2-20.

Elastic Stop Nut Corp. of America, 233 Vauxhall Rd., Union, N.J.

Use postpaid card. Circle No. 55

SELF-LOCKING HEX NUTS FOR SHORT-THREAD FASTENERS



Lightweight, low height, self-locking nuts for use on the new 160,000 psi short thread NAS screws and bolts have been designated the HI4 line.

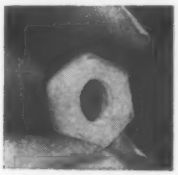
The hex nut series is 20 to 40% lighter, depending on thread size, than the lightweight self-locking hex nuts currently produced for 125,000 psi AN bolts.

The complete line of hex and anchor nuts now meets tensile requirements of MIL-B-7873 as well as MIL-N-25027. The fasteners incorporate a principle in which the upper threaded portion of the nut is deformed elliptically to produce self-locking action.

Kaynar Mfg. Co., Inc., Kaylock Division, Box 2001, Terminal Annex, Los Angeles 54, Calif.

Use postpaid card. Circle No. 56

TEN SIZES ADDED TO NYLON HEX NUT LINE



Ten sizes have been added to a line of molded nylon hex nuts. The new nuts range from a No. 2 through 5/16" screw diameter.

The nuts are self-locking and vibration proof when mated with screws having an interference fit. They have high resilience and elasticity, and excellent strength. Nylon's light weight makes it a favorable fastener material for low inertia assemblies and eliminates the need for stocking, handling and assembling separate insulating parts.

All nuts have a washer face, are double countersunk, made with a single chamfer and are standard thickness (except for the 5/16" sizes which are jam nuts) with unified series Class 2B threads.

Gries Reproducer Corp., New Rochelle, New York.

Use postpaid card. Circle No. 57

CLAMPS FOR ASSEMBLY OF STORAGE RACKS, FRAMES

Malleable iron fittings with set screws are used with plain end iron or steel pipe to build storage racks, frames for signs and exhibits, railings and frames.

The clamps are made in 56 styles for each pipe 3/8" to 2" diameter, assembled with standard Allen wrench. Set screws reported to support loads up to 4000 lbs. and structure can be easily dismantled and fittings reused.

Kee Klamps North America Ltd., 1079 William St., Buffalo 6, N.Y.

Use postpaid card. Circle No. 58

PRESS TERMINAL FEATURES FUSED GLASS INSULATION

A press terminal features green-glass insulation which is unaffected by moisture, acids, alkalis or fungus.

The green glass, fused at high temperatures, offers resistance to twist-out or pull-out of the contact. The terminal comes in nine contact styles, including standoff and feedthru, in three basic body sizes. Flashover rat-

CORROSION RESISTANCE

is our business at HARPER

Whatever your corrosion problem, Harper has the corrosion-resistant fastening to answer your need. Stainless Steels, Monel, Silicon Bronze, Naval Bronze, Brass, Copper, Aluminum, Titanium are standard metals at Harper. *In fact,* during the past 35 years, Harper has manufactured over 100 different corrosion-resistant alloys into HARPER EVERLASTING FASTENINGS. Millions of standard and non-standard items are carried in stock by Harper and Harper Distributors. See how Harper corrosion-resistance can help you. Write for the facts.

CORROSION-RESISTANT FASTENINGS

HARPER

ATTACH TO YOUR LETTERHEAD FOR THE COMPLETE REPORT

H. M. HARPER COMPANY
8204 Lehigh Avenue • Morton Grove, Illinois

Gentlemen:

Please send me your report on "Corrosion Resistance" at no cost or obligation.

Use postpaid card. Circle No. 233

ings are up to 3000 volts with contact ratings to 10 amperes.

The installation consists of punching or drilling one hole and pressing the part in place.

Rosan Inc., Dept. 40, 2901 West Coast Hwy., Newport Beach, Calif.

Use postpaid card. Circle No. 59

SELF-LOCKING METAL SCREW FOR 1200°F APPLICATIONS

A self-locking screw is designed for applications at temperatures up to 1200°F.

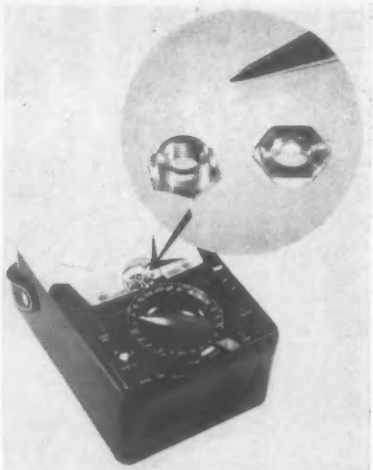
Made under a process which includes the use of an all-metal rolled tubular insert, torque action compresses the screw's insert. The resiliency of the metallic tube causes a re-forming action on the part of the insert, producing a locking effect on the screw.

The Hot-Lok is also claimed to be vibration resistant and provides weight-saving through the elimination of lock washers and safety wire. The screw is available in No. 2 sizes and up, minimum thread length ¼".

Long-Lok Corp., 2601 Colorado Ave., Santa Monica, Calif.

Use postpaid card. Circle No. 60

MINIATURE TURNED NUTS HELD TO +.000" AND —.005"



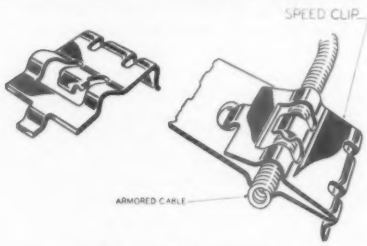
Miniature turned nuts are available in a range of types, shapes and sizes for use in precision instruments and miniaturized equipment.

These miniatures are supplied to specifications with standard or special threads (No. 0 and larger) in diameters as small as ⅛" hexagon. Lengths and diameters are held to +.000" and —.005". The nuts are tapped square with faces, countersunk on both sides, burrless, degreased and can be furnished in either single or double-chamfered styles and special shapes. Minimum lots of 5000 per individual item.

Fischer Special Mfg. Co., 496 Morgan Ave., Cincinnati 6, Ohio.

Use postpaid card. Circle No. 61

ONE-PIECE CLIP FOR ARMORED CONTROL CABLES

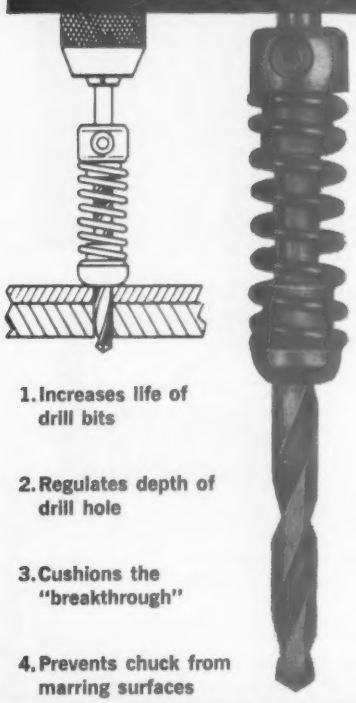


A one-piece clip designed to secure small-diameter armored control cables on electrical equipment, automobiles and in other applications, the Speed Clip offers positive vibration-proof fastening at any location along the cable and unlimited reuse without damage to cable or clip.

To assemble, a small L-shaped tab on the clip is inserted into a panel hole provided. The armored cable is then positioned between an embossed groove on the panel and a mating groove in the clip and is clamped securely in place as the clip is snapped over the panel edge. A sheared spring arm with turned down tabs extending from the

Stop Breaking Drill Bits!

WEDGELOCK DRILL STOP



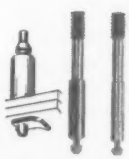
1. Increases life of drill bits
2. Regulates depth of drill hole
3. Cushions the "breakthrough"
4. Prevents chuck from marring surfaces

The Wedgelock Drill Stop consists of two steel end pieces connected by a coil spring. Slips over standard size drills from #50 to 5/16" dia., and is adjusted for required depth simply by tightening set screw. Special sizes available on request.

Wedgelock Clamps and Fasteners

Sheet Metal Clamps
Sets and releases with one hand in one operation. Many styles.

Edgelock Fasteners
Spring actuated. Powerful. Applied with pneumatic or hand pliers.



Speed Bolt Fasteners
Wide variety of holding pins to fit one standard body. Holds up to 250 lbs.

Wing Nut Fasteners
Handles thicknesses up to 2½". Adjustable pressure. Many sizes.

Spring-Actuated Fasteners
Fast alignment of rivet and bolt for lighter materials. Applied with pliers.

Wedgelock makes the greatest variety of fast-action clamps and fasteners in the country. For information on these and other Wedgelock products write—

WEDGELOCK CORPORATION
5446 Satsuma Avenue
North Hollywood, Calif.

Use postpaid card. Circle No. 234

assembly and fastener engineering

MAY, 1959

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281	282	283	284	285	286	287	288	289	290
291	292	293	294	295	296	297	298	299	300
301	302	303	304	305	306	307	308	309	310

EDITORIAL ITEMS

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

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assembly and fastener engineering

MAY, 1959

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301	302	303	304	305	306	307	308	309	310

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11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
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Calif.

ering

center portion of the fastener grips the spiral turns of the cable to prevent it from moving out of adjustment.

Tinnerman Products, Inc., P.O. Box 6688, Cleveland, Ohio.

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METAL RIVETS WITH PLASTIC INSULATED HEADS

Metal rivets are being manufactured with plastic heads providing insulation for over 5000 volts. The Caplet consists of a semi-tubular metal rivet whose head is completely encased in a high-impact strength plastic.

Standard sizes range from 1/16" to 1/8" shank diameters and lengths in multiples of 1/32". Metal shanks are available in any cold-headable material with special plating available.

The fasteners can be hopper fed and automatically set for use in the electrical and electronic industries.

Pylon Co.,. Inc., Attleboro, Mass.

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LAB, INDUSTRIAL CLAMP, STRUCTURAL BUILDING UNIT

A laboratory and industrial clamp fastener is for building, mounting, supporting, holding or clamping. The Versa-Loc is a structural system consisting of a mounting angle and a clamp.

The clamp is available in four variations: for ½" rod or tubing, ¼" or ⅛" pipe, and for ⅜" BX (fitted with a rubber grommet to insulate and protect the wires at the cable exit). The angle is provided with tapped holes on two sides for mounting micro type switches, and with mounting holes for No. 10 screws. It serves both as the "jump-off" point and as an end point mounting device.

All five units are equipped with locking teeth which are engaged in a vise-like grip when the screw is tightened. Any unit will match with any other, or with a like unit, to give perpendicular or parallel relationships, or angular positioning in ten degree increments.

Versa-Loc Corp., Southern Blvd., Chatham, N.J.

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Exciting new best seller! Yours FREE!

The Wilton Catalog Cover and Sample Spread Tells The Story

Wilton's new "book" is more than a catalog! It's actually a production know-how manual that shows you in-plant photos and operating case histories of how Wilton clamping tools (both manual and powered) have been used by the best brains in the business to save production time and money. Of course we show our line, and that too is unique—**Wilton has the most complete line of clamping tools in the world.** Write for your copy now; it's an education that will pay dividends in your plant. No obligation, of course.

WILTON

Wilton Tool Manufacturing Co., Inc., Schiller Park, Illinois

AFE 59

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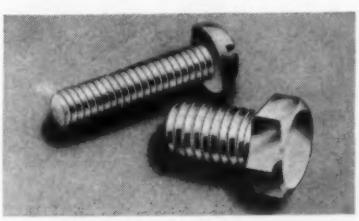

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Every one a "special" fastener

You're looking at "specials"—steel fasteners made to meet a particular need. They are representative of the hundreds of types of specialties which we design and manufacture at our plant at Lebanon, Pa.

Our engineering staff has tackled just about every fastener problem you could imagine. Frequently they come up with suggested design changes resulting in substantial savings for the user.

As for variety of fasteners, the sky is the limit. Long, short, heavy or light. Headed, threaded, bent, or upset.

If you think a special might do a better job than the standard bolt you are now using, let us go to work on it. We'll give it our full attention, then offer recommendations. But if we find that a standard bolt is the answer, we'll gladly tell you so.

Fair enough? Then all you need do is get in touch with the nearest Bethlehem sales office. We'll have an experienced representative call at your convenience.

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USEFUL LITERATURE

To receive your copy of any literature reviewed here, use the postpaid card opposite page 58.

HINGED PAN CONVEYORS

A four-page, two-color, 8½ by 11-in. bulletin (No. 58-1), describes the application of hinged pan conveyors in quench tanks, scrap movement, foundries, food processing and machined part handling. Detailed drawings of hinged pans and photographs illustrate various existing installations of hinged pan conveyors used to move a wide range of material sizes and weights. Anchor Steel and Conveyor Co., 6906 Kingsley, Dearborn, Mich.

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AUTOMATIC SCREWDRIVER

How an automatic screwdriving system can save up to 60% of operator fastener driving time is told in a four-page brochure. The Tru-Tork pneumatic power screwdriver, hopper feed and plastic tube drive screws up to 2½" in length, operating up to 50' from the hopper. Advantages, photos included. Clyde Engineering & Mfg. Corp., 937 E. 10 Mile Rd., Hazel Park, Mich.

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DOUBLE-DUTY LOCKING NUT

The two-way fastening of the Speed Nut—an inward thread lock and outward spring lock—is sketched and various types specified in 16-page Bulletin 350-1. The attractive pamphlet illustrates nuts in use as grips, clips, clamps, latches, molding, tubing, retainers, all design variations from the basic flat push-on fastener. Tinnerman Products, Inc., Box 6688, Cleveland 1, Ohio.

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BRAZING STAINLESS STEEL

"How to Braze Stainless Steels" discusses in detail four aspects of the brazing process: (a) characteristics of base and filler metals; (b) brazing cycles; (c) selecting and using gas atmospheres; (d) construction and application of various types of furnaces. Author H. M. Webber, manager of process engineering for Harper Electric, is a recognized authority on furnace brazing, sintering and protective atmospheres. Harper Electric Furnace Corp., 39 River St., Buffalo 2, N.Y.

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WIRE STITCHING, STAPLING

Informative four-page Circular AD-611 uses the question and answer method to present stapling and wire stitching. Twenty-four typical wire shapes are illustrated with application discription about each. Portable and stationary tools are pictured and described. Bostitch Co., 16 Briggs Dr., East Greenwich, R.I.

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BLIND LOCKING BOLTS

A two-page circular presents the Jo-Bolt blind locking bolt: its performance, its advantages in terms of design. An illustrated sequence describes installation. It is said to have 95,000 psi shear strength minimum for steel fasteners, 57,000 psi for aluminum. National Screw & Mfg. Co., 2440 E. 75th St., Cleveland 4, Ohio.

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RUST PREVENTIVE

A thin film rust preventive, developed for application where spraying methods are most feasible, is described in Bulletin 62. Removal of the moisture-absorbing, non-oily film is not necessary before plating or painting. The product is applicable for parts storage. Rust-Lick Inc., 755 Boylston St., Boston 16, Massachusetts.

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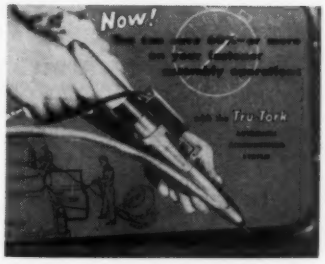
PARTS-FEEDING MACHINES

A new product information folder contains descriptions and specifications of a wide variety of "building-block" type automation machines for mechanizing and integrating production and

(See 70)



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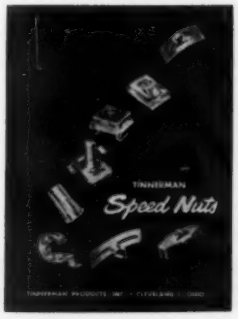
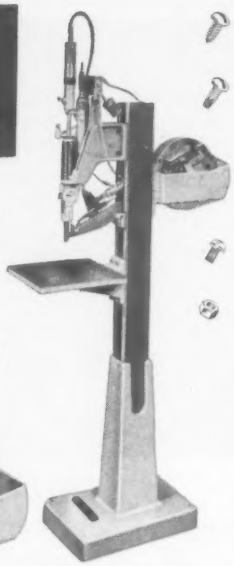


(See 72)

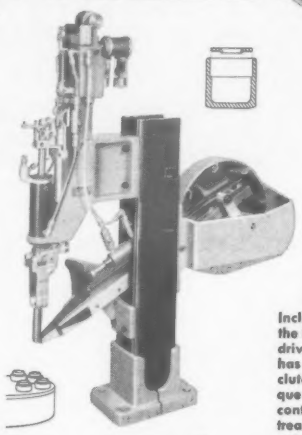
DIXON AUTOMATIC ASSEMBLY EQUIPMENT

For fast, accurate assembly of small parts, DIXON has developed two types of equipment: *Auto-Positioners* for automatic assembly work and *Auto-Torque Drivers* for automatic placing and the driving of screws and nuts. Many combinations of standard machines and components are available.



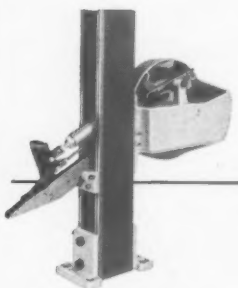
AUTO-POSITIONER

This small-parts assembly machine is available as a completely automatic station (at right) for use at a dial or straight transfer table, or it can be furnished as a self-contained machine with work table and foot treadle to initiate the cycle. Has positive-acting piece-parts feeder and sensing mechanism to stop the machine if part is missing or improperly placed. Easy to install and tool.



AUTO-TORQUE DRIVER

Including all major features of the DIXON Auto-Positioner, this driver for screws and nuts also has a compact air motor and a clutch that provides precise torque control. Furnished as a self-contained machine with foot-treadle control (above) or as an automatic station for use at dial or straight transfer table.

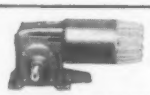


PIECE-PARTS FEEDER

Operated by an air cylinder which actuates the feeder drum and shuttle-type escapement, this feeder delivers parts to assembly machines or other equipment. The straight track and positive-acting escapement permit low-angle mounting and provide efficient parts control.

PARTS ESCAPEMENT

Releases parts singly or in multiples. Simple, efficient, operates at speeds up to 200 per minute. Models for air, solenoid or mechanical operation.



INTERMITTENT DRIVE

A compact clutch-brake unit, designed for accurate start-stop cycling of indexing mechanisms for assembly or other work. Wide range of speeds and torques.

Descriptive Bulletins will be sent on request.

DIXON **DIXON AUTOMATIC TOOL, INC.**

2309-23rd Avenue • Rockford, Illinois

EQUIPMENT FOR AUTOMATIC PARTS HANDLING AND ASSEMBLY

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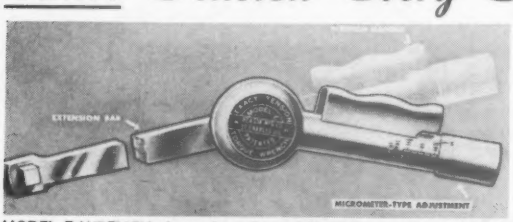
Exact Tension Every Time when you use a



REASOR TORQUE WRENCH

NO DIALS, GAUGES, FLEXING BEAMS OR RODS

Positive Results Guaranteed

MODEL E WRENCH shown here is an all-purpose wrench with ½" square drive and a range of up to 35 foot pounds without extension bar. Furnished for clockwise or counterclockwise operation. 12" extension with ½" drive increases range to 100 foot pounds. 18" extension with ¾" drive increases range to 70 to 175 foot pounds. Wrench only . . . $36.00 12" extension . . . $3.50 18" extension . . . $8.50

Write for free four page folder giving full details and description of other models.

REASOR MANUFACTURING COMPANY
ST. CHARLES ILLINOIS

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assembly operations. These include floor feeders and orientors, rotary hoppers, self-compensating grinder controls, high speed automatic hardness testers and electronic inspection systems for multiple dimension gaging and selective segregation of parts. Radio Corporation of America, Industrial and Automation Div., 12605 Arnold Ave., Detroit 39, Michigan.

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COLD-HEADING MACHINE

Cost cutting with a one-die boltmaker is the theme of a multi-folded flyer, claiming 175 finished fasteners (5/16" size) per minute for a cold-heading machine. Design features illustrated include heading, flo-pointing and thread-rolling, all in one unit. National Machinery Co., Tiffin, Ohio.

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THREADED PIPE PLUGS

Standard AN pipe plugs are treated in a two-page flyer. Designed for aluminum and other non-ferrous metals, the plugs' self-sealing principle is explained and test reports charted. Lock Thread Corp., 2832 E. Grand Blvd., Detroit 11, Michigan.

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TAPER, DOWEL PINS

Close-tolerance ground taper and dowel pins are described in a four-page circular. Stainless steel taper pins from .046" to .341" in diameter and from ¼" to 3" in length are specified. Horberg Grinding Industries, Inc., 19 Staples St., Bridgeport 1, Conn.

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WELDING NUTS

Where and how to use welding nuts to best advantage is told in a six-page booklet. An added section deals with special requirements imposed by the nature of your product: how to anchor the projection welded fastener without affecting the appearance of, say, an appliance; how to avoid rattles when vibration is present; and how to simplify field servicing procedures. Concluding paragraphs give a generalized description of the manufacturing requirements for the use of welding nuts and the automatic feeding and welding machines that have been developed. Owosso Div., Midland-Ross Corp., Owosso, Mich.

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ONE-UNIT WASHER, NUT

Pre-assembled lock washer and nut units are covered in eight-page Form AS-88-R1. Key features and uses are illustrated and the external, dish and domed, plain dished and conical and sealing washer types specified. Every

washer has six or more locking teeth. Shakeproof, St. Charles Rd., Elgin. Ill.

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RETAINING RINGS

Four series of industrial retaining rings are specified in a 16-page, two-color catalog. External rings applied radially to shafts are available in dispenser stacks. The data is accompanied by application suggestions and dimensional drawings. Industrial Retaining Ring Co., 57 Cordier St., Irvington 11, New Jersey.

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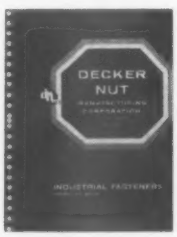

CLINCH, WELD, HEX NUTS

Engineering data on a line of nuts is presented in a 20-page loose-leaf catalog. Dimensional drawings and pictures accompany size, thread, weight, application information on clinch, weld, hex, lock nuts and square socket pipe plugs. Cold-heading facilities are outlined. A handy chart compares Unified and American standard series. Decker Nut Mfg. Corp., 1933 Clark St., Albion, Mich.

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FASTENING INTO CONCRETE

Powder actuated fastening into steel or concrete with a pistol-like tool is described in an eight-page catalog. The three step operation is illustrated, and actual size photographs of all model fasteners are included. Speed of use is said to be up to 15 times faster than other methods. Ramset Fastening System, 12117 Berea Rd., Cleveland 11, Ohio.

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SOLDERING ALUMINUM

Handy-size reference booklet on the soldering of aluminum includes data on fluxes, irons and flames, and gives complete information on actual soldering methods such as hot plate, dip, furnace, glass fiber brush and ultrasonic operations. Types and properties of aluminum solders are explained, plus the corrosion of soldered joints and their performance in aluminum. Text is supported by diagrammatic illustrations. Reynolds Metals Co., Dept. PRD-6, Box 2346, Richmond 18, Virginia.

Use postpaid card. Circle No. 89

LOCK NUTS

Lock nuts are primarily discussed in an eight-page bulletin, with projection weld nuts also introduced. Locking principles, torque, material, threads and complete ordering specifications are included on two-way lock nuts, spin-lock nuts, hex and standard lock nuts. Illustrated. MacLean-Fogg Lock Nut Co., 5535 Wolcott Ave., Chicago 40, Ill.

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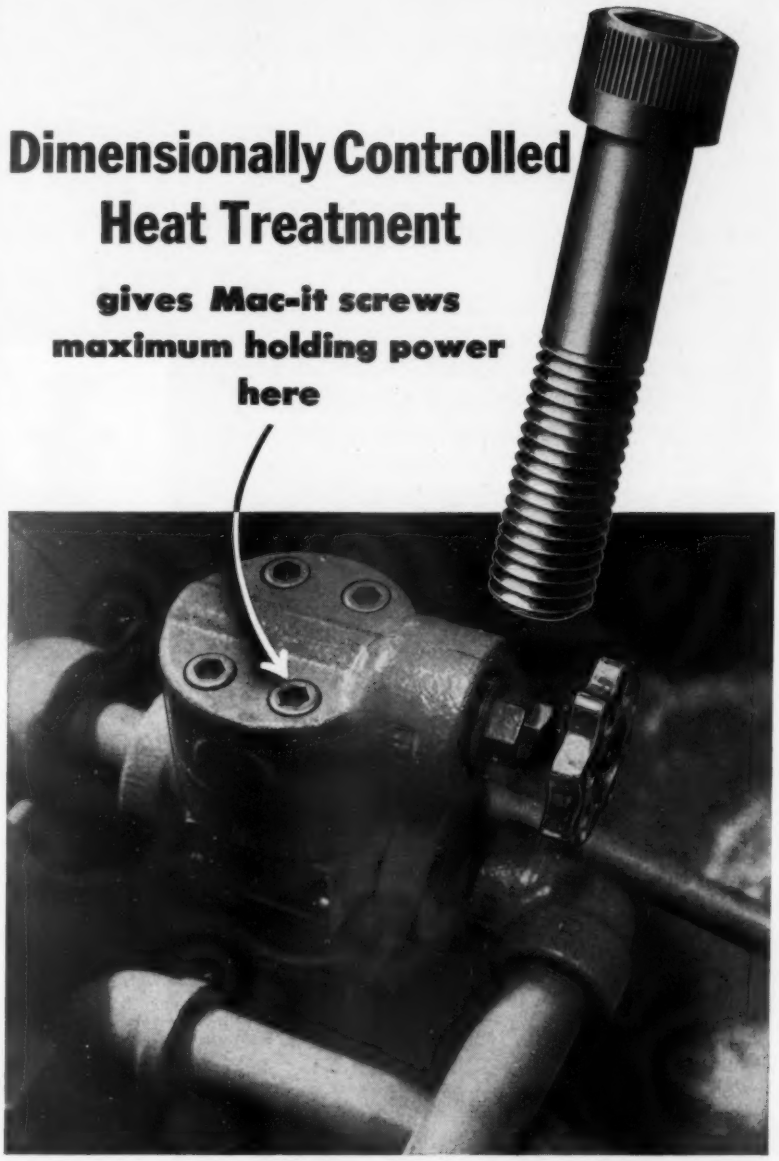
Dimensionally Controlled Heat Treatment

gives Mac-it screws maximum holding power here



End-use requirement is an important factor in determining heat treatment specifications for Mac-it alloy steel screws. While physical dimensions are a prime factor, the proper combination of strength, toughness, ductility and resistance to shock and vibration must be achieved if the correct torque-tension—or holding power—is to meet your exact requirements.

Mac-it metallurgists determine a heat treating cycle that takes into consideration material, size *and* end use. This combination-of-three results in Mac-it screws with maximum holding power.

Every step in the manufacture of Mac-it screws is followed with care by specialists who know what you want—and want you to have it. That's why Mac-its *hold tight in a tight place!*

Buy by name from your distributor—buy Mac-it

Mac-it®

NEW SPECIFICATION SHEET listing new 1960 Series Socket Screw Industry Dimension Standards. Write for your *free* copy.

Mac-it Parts Co., Dept. 20, Lancaster, Pa.

MAC-IT ALLOY STEEL SCREWS

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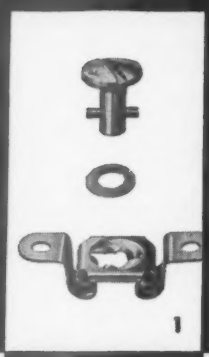
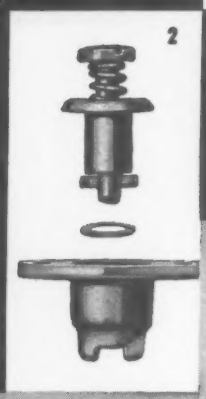
specialists in fasteners for industry

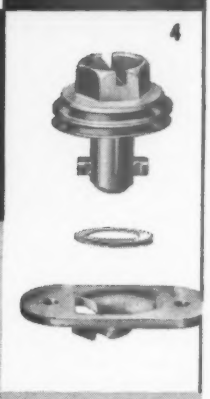
speed · versatility · positive performance

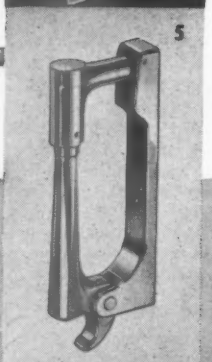
Outstanding creative engineering at Camloc has produced a variety of fastening devices. For access panels, doors, other closures, for simplified replacement of components and sub-assemblies. There are other fastening devices, designed for a variety of specialized applications, all of them retaining the three important features that characterize all Camloc products . . . speed, versatility and positive performance.

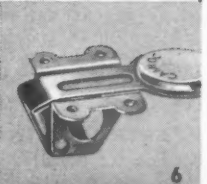
CAMLOC



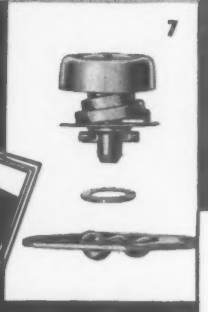


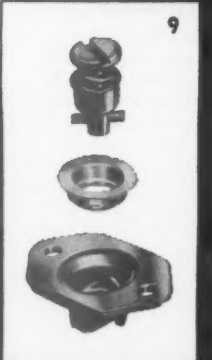






1. 5F fastener for thin materials
2. 2600 Series Quarter-Turn
3. Miniature Toggle Tension Latch
4. 91F Heavy Duty Quarter-Turn
5. Electronic Chassis Latch
6. Push Button Latch
7. 28F Series Quarter-Turn
8. 7C Harness Clamp
9. 4002 Series Quarter-Turn
10. SPF (Stressed Panel Fastener)





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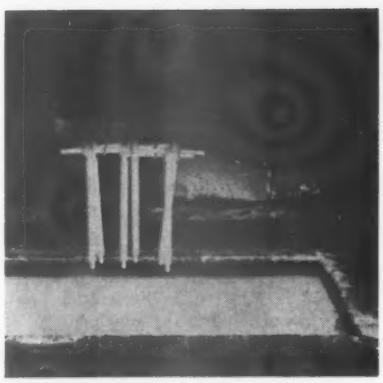
INDUSTRY MAKES NEWS



White-hot C-clamp spindles are removed from heat-hardening "fire bath" process at Wilton Tool.

High production Bliss press installed at Waldes Kohinoor operates at 1000 spm.

WILTON 'FIRE-HARDENS' C-CLAMP PARTS

All components which make up the Wilton Tool C-clamp line are being given a newly developed "fire bath" processing for extra strength. The Schiller Park, Ill. firm immerses the parts—including spindle, casting, and handle—in 1600° F. liquid. The intense heat changes the molecular structure of the steel, causing closer inter-relationship and hardening.

WALDES INSTALLS HIGH SPEED PRESS

Retaining rings at the rate of 3000 per minute are being stamped on a new 25-ton press at Long Island City, N.Y. plant of Waldes Kohinoor, Inc.

The Bliss triple-cavity die Model 1625 has a capacity of 1000 strokes per minute. Special design features permit its high speed, including a counterbalancing system which works in opposition to the force frequencies set up by the slide and, in effect, nullifies them, thus minimizing vibration.

It has a recirculating oil system monitored by interlocks which stop the press instantly if the pressure varies either up or down from the line pressure of five lbs. (and register the point of failure). An electric clutch permits rapid torque pick-up and quick stops, and there are roller bearings on the throw block.

WERNTZ URGES USER-SUPPLIER COOPERATION

Too many companies spend more for their purchased component parts than necessary, principally because there exists a lack of proper communication and mutual confidence between themselves and their suppliers.

This statement comes from Orrin B. Werntz, executive vice president of the National Screw Machine Products Association, Cleveland, who says that lack of proper supplier-customer confidence is costing American industry millions of dollars every year.

"Of particular importance are supplier suggestions on how to most effectively design and order parts, oftentimes simple suggestions that reduce costs, make possible better customer service, and in cer-

continued

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like some of the samples shown here . . . or the more commonly used tubular and split rivets . . . they're all alike to the American Rivet Co. And always—our own special brand of quality and service that gets you what you want when you want it.
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tain cases, actually improve the quality of the part."

The NSMPA executive adds that even with these obvious and important advantages to be gained, user companies too often withhold vital basic information. For example, the supplier, in many instances, is not told the use of the part he is making, or even the estimated total quantities needed.

TAYLOR ELECTED STANDARD SCREW PRES.

Standard Screw Co., Bellwood, Ill., announced the election of James A. Taylor as its new president. The former vice-president succeeds W. D. Corlett who advances to chairman of the board.

As president of Hartford Machine Screw Co., Taylor will continue to direct activities of this Standard division and plant in Hartford, Conn. Corlett will do likewise for the Chicago Screw Company Division. Additional divisional headquarters and plant facilities under their supervision are Ravenna Metal Products, Seattle; Hartford-Greenville, Greenville, S.C., and The Western Automatic Machine Screw Company.

ASME HOLDS TWO MEETINGS IN JUNE

Two conferences will be sponsored by The American Society of Mechanical Engineers in the month of June. The semi-annual meeting of the society will be held Jun. 14-18 in the Chase-Park Plaza hotel in St. Louis, Mo., followed by the Applied Mechanics Div. conference Jun. 18-20 at Virginia Polytechnic Institute, Blacksburg, Va.

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Whatever your fastener requirements may be, Long-Lok Self-Locking Screws assure highest reliability, plus substantial cost savings in weight, time and labor. Available in aircraft and commercial qualities. Write for free Bulletin LL-58.
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FABRICATED PRODUCTS SPONSORS CLINIC

A fastener clinic held in Detroit, Mich. was sponsored by Fabricated Products Co., Pittsburgh, Pa. Company officers present included president J. R. McKee, Jr., assistant to the president Paul Jellison, sales manager Dan Black, advertising manager Charles Hoyes.

PITTSBURGH SCREW GOES TO NET PRICING

Pittsburgh Screw and Bolt Corp., Pittsburgh, Pa. has adopted a new item net pricing system, replacing its list and discount method.

The price schedule sent to customers and distributors will cover 75% of the firm's fastener line. In addition, the company has announced that shipments over 20,000 lbs (truckload) will be delivered with no freight charge.

H. M. HARPER CONTINUES EXPANSION

The H. M. Harper Company, Morton Grove, Ill., has announced its program for 1959 capital expenditures.

During the year, it is anticipated that the fastener manufacturer will expand three-quarters of a million dollars for new facilities, equipment, and buildings. Facilities in both the Metals Mfg. Div., as well as the Bolt Div., will be augmented in the expansion program. In addition, the

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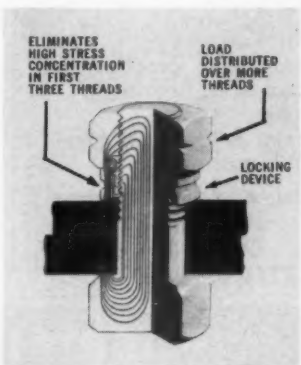

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- Ability to deliver dependable operation in critical applications up to 1600°F, tested and proved.
- Free running feature reduces assembly time.
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- Ideal for hand and power wrenches.

Manufactured in CHROMEL (P), ALUMEL, 303, 304 ,347, A-286 and other materials in machine screw sizes No. 2-56 and up, and all fractional sizes. National Fine and National Coarse Threads meet MIL-N-8056 specifications.

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company is establishing Canadian warehousing facilities.

Harper recently established a wholly owned subsidiary in Canada, Harper Everlasting Fastenings, Ltd., located at 27 Chauncey Ave., Toronto, Ontario. The organization is headed by Will W. Boyes, vice-president.

HITCHCOCK ACQUIRES PLANT MAGAZINE

Plant Publishing Co. and its property The Plant, have been purchased by Hitchcock Publishing Co., Wheaton, Ill. This monthly magazine is read by some 48,300 men who engineer and maintain the nation's large manufacturing, extracting, power and service industry plants. The merger is expected to result in improved service to both readers and advertisers. No changes are contemplated in publishing objectives and the magazine headquarters will soon be moved to Hitchcock's new $350,000 building in Wheaton, Ill. W. T. Watt continues as publisher, H. E. Hollensbe as editor, and W. E. (Ed) Poole as managing editor.

BARNES TO DIRECT 3M RESEARCH AS V-P

Carl E. Barnes was named vice-president for research at Minnesota Mining & Mfg. Co., St. Paul, Minn. The company announced that his previous position as director of central research will be filled by John W. Copenhaver.

BUTCHER & HART TO EXPAND PLANT

Butcher & Hart Mfg. Co., Altoona, Pa., has announced plans to expand its plant 50%. The bulk of new machinery will be used for the conversion of hot rolled rods into cold drawn material. Further integration of operations will broaden plating and other departments.

TEXTRON PURCHASES TOWNSEND COMPANY

Control of the Townsend Co., New Brighton, Pa. has been acquired by purchase of 80% of stock by Textron, Inc., of Providence, R.I., announced Townsend president F. R. Dickenson. The cash value of the shares was $4.3 million.

The fastener manufacturing firm, with annual sales of $20 million, will be operated as a wholly-owned subsidiary of Textron with present personnel and policies preserved intact.

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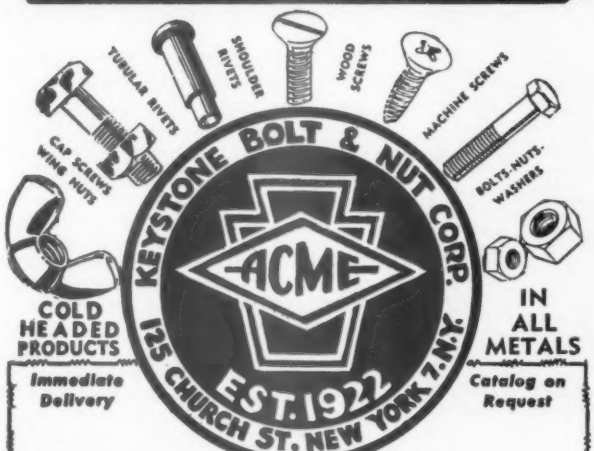

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When the chips are down "KEYSTONE" is your best bet to solve all your fastener problems. We Maintain the Largest Stock of BOLTS, NUTS, SCREWS, RIVETS & WASHERS in different metals, sizes and types, on the east coast. You're sure to find them here! And we will get them to you fast.

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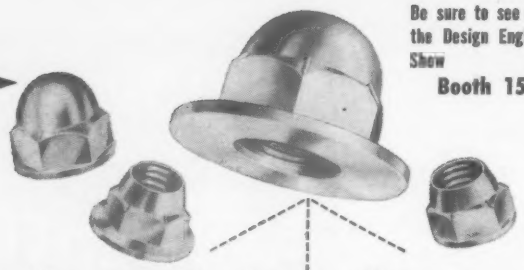
GRC idea



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Booth 1524

GRC die cast zinc alloy
washer-base
CAP NUTS

GRC makes new exclusive low cost fasteners with integral Washer Bases for better fastening performance and appearance. Won't mar soft surfaces. Use with oversize or offset holes. Prevents wrench marks. All these advantages at no extra cost to you. Use standard diameter nuts wherever regular cap nuts are used alone—full diameter wherever regular cap nuts would be used with separate washers.

Standard thread sizes from No. 4 through ½"—14 hex sizes.
- **Rustproof and corrosion resistant**
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- **Save assembly time—inventory costs**

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It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: *their cost is so low they can be even thrown away when dull.* For example, for approximately $50 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW-THREAD DIGEST"

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DESIGN ENGINEERING SHOW

(continued from page 47)

1333. The automatic heading of small parts will be exhibited, showing heading with secondary operations to be versatile and fast. Technical service will be available to recommend and specify parts.

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VLIER ENGINEERING

The design and application of a line of tooling accessories will be featured in Booth 1044. Spring and ball plungers, torque thumb screws, toggle and leveling pads, swivel-pad clamps, fixture keys and spring stops enable parts to be produced faster, with economy, and to be machined to closer tolerances.

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WALL COLMONOY

The complete line of Nicrobraz brazing alloys for high temperature service and various products for promoting and controlling wetting and flow will be featured in Booth 1050. The new Nicrocoat process-sheet metal parts with a furnace-bonded protective surface layer—will be shown.

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SOUTHCO

A miniature adjustable pawl fastener will be featured in Booth 1005. Eliminating methods usually required to hold the fastener body to door or panel, this fastener's shaft fits in one 9/16" diameter hole while another .082" hole receives a stop pin to prevent the fastener from rotating. The fastener automatically adjusts its pawl position to frame thickness up to ¼"x, and is shipped as an assembled unit except for lock washer and mounting nut.

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Don't Miss These!

Among the other exhibitors and their booths are: Acme Steel Co. (No. 807), Aeroquip Corp. (No. 1132, 1134, 1136), Aluminum Co. of America (No. 1324), Associated Spring Corp. (No. 1313), Camloc Fastener Corp. (No. 1124), Carr Fastener Co. (No. 1026), Chain Belt Co. (No. 605), Corbin Cabinet Lock Div., The American Hardware Corp. (No. 418), Eastman Chemical Products, Inc. (No. 1213, 1217, 405), B. F. Goodrich Aviation Products (No. 1532), Handy & Harman (No. 115), Heyman Mfg. Co. (No. 1110), Hunter Spring Co. (No. 211), Link Belt Co. (No. 1436, 1438), Mac-It Parts Co. (No. 1611), Nylok Corp. (No. 1355), The Palnut Co. (No. 1032), Parker-Kalon Div. (No. 1349), Ramsey Corp. (No. 1606), Raybestos-Manhattan, Inc. (No. 1553, 1555), Russell, Burdsall & Ward Bolt and Nut Co. (No. 1212), A. Schrader's Son Div. (No. 1429), Sealol Corp. (No. 1429), Edwin B. Stimpson Co., Inc. (No. 1225), Tubular Rivet & Stud Co. (No. 1354), United Shoe Machinery Corp. (No. 1100), and Waldes Kohinoor, Inc. (No. 413).

Index to Products Advertised

Assembly machines, 51, 62

Bolts, 2, 69, 71, 4th Cover

Clamping devices, 58, 59, 64

Die heads, 70

Drill stops, 58

Fasteners
- Aircraft, 28, 71
- Cold headed, 2, 18, 21, 22, 34-A, 69
- Corrosion-resistant, 57, 71
- Quarter-turn, 64
- Sandwich panel, 28
- Special, 10, 21, 59, 60, 64, 68, 69

Feeders, parts, 51, 62

Latches, 45, 48, 64

Nuts
- Cap, 70
- Lock, 67
- Self-retaining, 23
- Wing, 58

Parts, cold-headed, 2, 18, 21, 22, 34-A

Pins, locking, 41, 58, 71, 3rd C.

Plugs, 35

Pliers, 52

Plungers, ball, 45

Retaining rings, 9, 12

Rivets, 17, 66

Riveting machines, 17

Screwdrivers, air-powered, 14

Screwdriver tips, 69

Screws
- Phillips, 16, 20, 36
- Self-locking, 66, 68
- Self-tapping, 3, 6, 4th Cover
- Socket, 13, 29, 50, 53, 63
- Weld, 44

Sealants, 54

Tooling accessories, 45

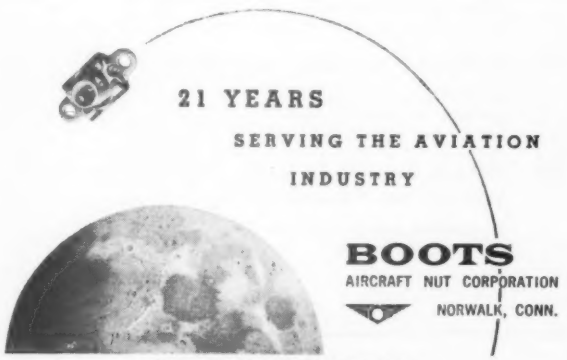
Washers, special, standard, 56

Washers, self-sealing, 8

Wrenches, torque, 45, 62

Torque testers, 62, 67

Services
- Problem analysis, 2nd Cover, 2, 4
- Fastener testing, 68



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CONTENTS IN THIS ISSUE

Don't overlook these articles

FEATURES

24—Tightening Threaded Fasteners

This is first part of two-part article on subject of "power tools for tightening fasteners".

30—The Design and Application of Retaining Rings

What types are available? How are they effectively used and assembled?

37—Computer Assembly Techniques

Description of complexities involved in the assembly of a highly-precision electronic product.

42—Progressive Line Changes Boost Welding Efficiency

Temco comes up with some new ideas to facilitate gas heater production.

46—Design Engineering Show

A press-time review of some of the products to be exhibited in Philadelphia, May 25-28.

ASSEMBLY IDEAS

15—New Dip Brazing Furnace

An electrode-type salt bath furnace has been designed to braze aluminum components.

16—Automate Air Conditioner Line

York cuts costs 34% while making 90 units an hour.

17—Reduce Soldering Rejects

Boeing develops soldering method for heat-sensitive parts.

REPORTS FROM THE FIELD

19—Welding Methods for Rambler

American Motors uses gas, arc and resistance welding.

19—Adhesive Bonding Cuts Weight

Albertson solves design and production problem for power tool motors.

20—Attach Auto Trim with Weld-Type Fasteners

Primeweld cuts 11-step job down to three steps.

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INDEX TO ADVERTISERS

A

ACCURATE THREADED FASTENERS INC. 44
ALLEN MANUFACTURING COMPANY, THE 53
ALMAY RESEARCH & TESTING CORPORATION 68
AMERICAN RIVET COMPANY, INC., THE 66
AMERICAN SCREW COMPANY 16, 20
AMERICAN SEALANTS COMPANY 54
ANCHOR FASTENERS INC. 68
ARO EQUIPMENT CORPORATION, THE 14

B

BARTITE PRODUCTS CORPORATION (Sub. of L. J. Barwood Mfg. Co., Ind.) 8
BETHLEHEM STEEL COMPANY 60
BOOTS AIRCRAFT NUT CORPORATION 71
BRISTOL COMPANY, THE 29
BUFFALO BOLT COMPANY 2

C

CAMLOC FASTENER CORPORATION 64
CARLTON SCREW COMPANY 50
CARR FASTENER COMPANY (United-Carr Fastener Corporation) 23
CHICAGO RIVET & MACHINE COMPANY 17

D

DELRON COMPANY, INC., THE 28
DETROIT POWER SCREWDRIVER COMPANY 51
DIXON AUTOMATIC TOOL INC. 62
DRIV-LOK SALES CORPORATION 71

E

EASTERN MACHINE SCREW CORPORATION 70
EASTERN STATES SALES COMPANY 59
ELASTIC STOP NUT CORPORATION OF AMERICA 41
ELCO TOOL & SCREW CORPORATION 35

F

FEMCO MANUFACTURING COMPANY 68
FERRY CAP & SET SCREW COMPANY, THE 18

G

GENERAL AMERICAN TRANSPORTATION CORPORATION (Parker-Kalon Division) 3
GRIES REPRODUCER CORPORATION 70

H

HARPER COMPANY, H. M. 57
HASSALL INC., JOHN 2
HOLO-KROME SCREW CORPORATION, THE 13
HUBBELL INC., HARVEY 22

I

ILLINOIS TOOL WORKS (Shakeproof Division) 6
INDUSTRIAL RETAINING RING COMPANY 12

J

JOLIET WROUGHT WASHER COMPANY 56

K

KEYSTONE BOLT & NUT CORPORATION 69
KLINCHER LOCKNUT CORPORATION 67

L

LAMSON & SESSIONS COMPANY, THE 4
LONG-LOK CORPORATION 66

M

MAC-IT PARTS COMPANY 63
MAGNA DRIVER CORPORATION 69

N

NATIONAL LOCK COMPANY 69
NYLOGRIP PRODUCTS 71

P

PARKER-KALON DIVISION (General American Transportation Corporation) 3
PHEOLL MANUFACTURING COMPANY 2nd Cover
PROGRESSIVE MANUFACTURING DIVISION (The Torrington Company) 21

R

REASOR MANUFACTURING COMPANY 62
REPUBLIC STEEL CORPORATION 71
ROCKFORD SCREW PRODUCTS COMPANY 34 A-F
ROSAN, INC. 10

S

SCREW RESEARCH ASSOCIATION 36
SHAKEPROOF DIVISION (Illinois Tool Works) 6
SIMMONS FASTENER CORPORATION 48
SKIDMORE-WILHELM MANUFACTURING COMPANY 67
SNAP-ON TOOLS CORPORATION 52
SOUTHERN SCREW COMPANY 4th Cover
STANDARD PRESSED STEEL COMPANY 3rd Cover

T

TORRINGTON COMPANY, THE (Progressive Manufacturing Division) 21

U

UNITED-CARR FASTENER CORPORATION (Carr Fastener Company) 23

V

VLIER ENGINEERING CORPORATION 45

W

WALDES-KOLINOOR, INC. 9
WEDGELOCK CORPORATION 58
WILTON TOOL MANUFACTURING COMPANY, INC. 59

ONE LAST WORD

YOUR MORTAL ENEMIES, THE DETRACTORS

Man's struggles forward have ever been dogged and made more torturous by homo detractus. This species of the human race are the little minds who decry the endeavors of others. If they cannot discourage the Kitty Hawk from taking wing they deride the value of it. To them nothing is possible, nothing has value unless they themselves are the originators. They would be the axes around which galaxies revolve; they would be Magellans, Galileos or Rembrandts, but failing this they've taken as their motto, "The next thing to greatness is the slandering of it."

Whether you are an engineer, designer or a production leader your safety from homo detractus lies only in anonymity; such a craven self-denial is not associated with a man of action. Once you've hacked through the impenetrable jungle with an original thought the little minds will bay at your heels and belittle. It was so with Copernicus, Semmelweis, Bell and Fulton and so will it be with all who venture into the realm of new ideas.

Our complex industrial civilization has ever more urgent need of your specialized responsibilities in the fastening and assembling of America's products. In this area, which has had its Ford and he his detractors, your accomplishments will be bounded only by the breadth of your imagination. In the critical world of fastening, bonding and other joining methods your creative engineering will lead you into uncharted waters. Mechanized assembling, still in its infancy, looks to you for a pilot. But you will have your detractors: those who carp, It Can't Be Done; the ancestor worshipers who uphold the Old Way; those who question the value of it all. Such detractors, never to be confused with honest, objective criticism or respected competition, are your mortal enemies.

And if you succeed? You will only have succeeded! There is little more than the personal reward of a job well done, the satisfaction of accomplishment, the glowing pride of having helped place a satellite into orbit. Material rewards, plaudits and the respect of a few men of worth may also be yours, but of only one thing can you be deathly certain: the cawing clique of homo detractus will try to belittle your results.

And should you fail? Their glee and gloating will be ghastly. They are the camp followers of progress. They cannot be ignored, silenced or shunted aside; men of quality have always endured them. However, there is solace in the thought that try as they may, the Mighty Mac is built, a jet spans the globe, a missile roars into the night, and you, each in your field, helped to put them together and, in a small manner, helped mankind along.

Wm. J. Schleicher

Vice President & Editorial Director

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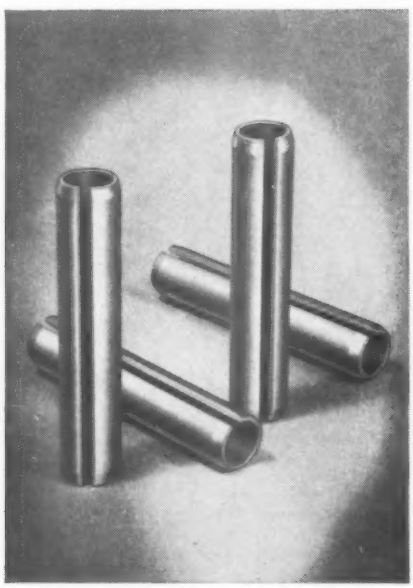

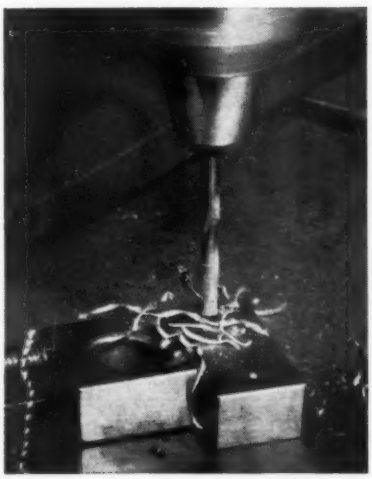

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